The Magazine for Sinclair users and Timex/Sinclair users

$2.95 (USA)
£1.50 (UK)

SYNC®

November/December 1982

Volume 2, Number 6

THEME SECTION:
SYNC AT THE DRAWING BOARD
4x4 Letters
Line Drawing
Curve Plotting

PROGRAMMING TECHNIQUES:
Line Print Utility
Translating 4K to 8K

MACHINE LANGUAGE:
Variables Transfer
Keyboard Scanning

HARDWARE:
A Remote Terminal

GAMES:
Random Walks
Keygame

ROM-PAC APPLICATIONS HAS PROGRAMS ON PLUG-ON ROM CARTRIDGES FOR THE ZX-81

*EDUCATIONAL PROGRAMS
*APPLICATIONS
*GAMES

Call or Write For Your
FREE
Information Package Including:
*Current list of products and prices
*Operating instructions for all products
*Sample applications
*Adds you to our mailing list to receive new product news
*Updates on using the Sinclair with and without our products

CALL 404-921-4471
OR WRITE

ROM-PAC APPLICATIONS
5921-A Alhambra
Norcross, Georgia 30093

Due to possible trademark infringement Sinclair Applications is now operating under the name of Rom-Pac Applications. Neither Sinclair Applications nor Rom-Pac Applications has or have had any connections with Sinclair Research Ltd.

We'll keep your Sinclair summing!

OUR $14.95 SINCLAIR AND TIMEX OWNER-PROTECTION SERVICE PLAN WILL SAVE YOU MONEY.

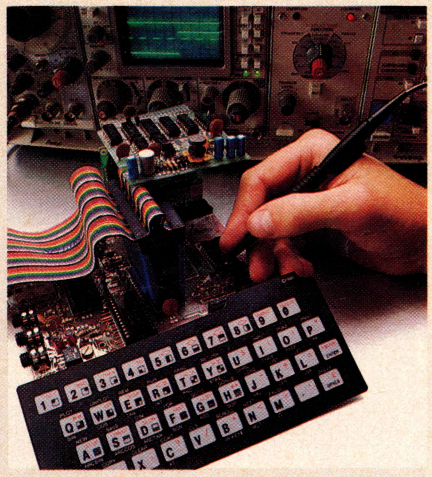
Timex too!

Typical repair charges for a Sinclair ZX81 can run from $25 or $50 up to the replacement cost of the unit. So why take chances? MicroSync will guarantee unlimited service for one year, *parts included*, at one low price. With return postage and handling paid. Plus our VIP treatment for fast turnaround.

MicroSync's experienced technicians are ready to service your ZX81 or Timex/Sinclair 1000 with factory replacement parts. We'll return it promptly, and we'll quality-check your unit before it leaves our service center.

We made over 10,000 Sinclairs tick last year.

Sinclair equipment has a great reputation for reliability. But almost all computer equipment requires service at one time or another. We've been repairing Sinclairs ever since their first glitch.



MicroSync is THE Sinclair authorized Service Center.

Your Sinclair computer is a remarkable assembly of electronic components, some unique to Sinclair technology. Our Sinclair personnel have been trained on, and service *only* Sinclairs.

We have the experience it takes. We have the parts on hand.

So act now! If your unit is less than 90 days old you can purchase our Owner-Protection Service Plan for only $14.95.

Mail To: MicroSync
162 Marlboro St
Keene NH 03431

Please send Maintenance Agreements for the equipment listed below:

ZX81 or Timex/Sinclair 1000

Less than 90 days old (include proof of purchase) ..... **$14.95 ea.**
Over 90 days old ..... **$34.95 ea.**

16K RAM

Less than 90 days old (include proof of purchase) ..... **$12.95 ea.**
Over 90 days old ..... **$29.95 ea.**

Total Enclosed ..... **U.S. $** _____

Serial nos. _____

_____

☐ check ☐ M/C ☐ VISA

Card # _____ Exp. _____

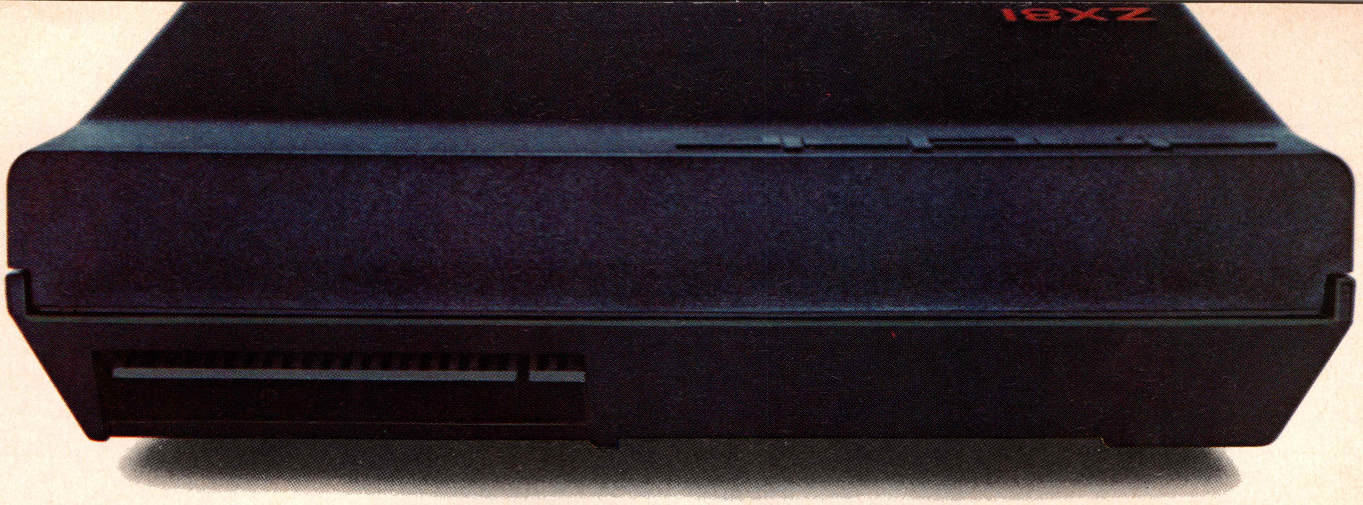
Name _____

Address _____

City _____ State _____ Zip _____

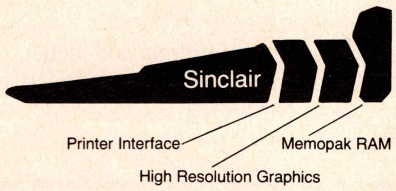
MicroSync
AUTHORIZED SINCLAIR SERVICE

The fine print. MicroSync's Maintenance Agreement covers all parts and service for 12 months after the expiration of original warranty. For units over 90 days old, coverage is for 12 months from the date of the Maintenance Agreement. Kits or modified units may require a surcharge. MicroSync may not repair units damaged by abuse or negligence. Liability extends to repair or replacement only.



BEHIND EVERY GOOD SINCLAIR IS A MEMOPAK

If you own a Timex-Sinclair 1000 or ZX81 computer, you should have a Memopak behind it. From increased memory to high resolution graphics, Memotech has a Memopak to boost your system's capabilities. Every Memopak peripheral comes in a black anodised aluminum case and is designed to fit together in "piggy back" fashion to enable you to continue to add on and still keep an integrated system look.



Order at no risk

All Memotech products carry our 10 day money back guarantee. If you're not completely satisfied, return it in ten days and we will give you a full refund. And every Memotech product comes with a six month warranty. Should anything be defective with your Memopak, return it to us and we will repair or replace it free of charge. Dealer inquiries welcome. To order any Memotech product call our toll-free number **800/662-0949** or use the order coupon.

MEMOTECH
CORPORATION

7550 West Yale Avenue
Denver, Colorado 80227
(303) 986-1516
TWX 910-320-2917

Mail to: Memotech Corporation, 7550 West Yale Ave., Denver, CO 80227
Code: SYCO-11-12

	*Price	Qty.	Total
64K RAM	$179.95		
32K RAM	109.95		
16K RAM	59.95		
Centronics Parallel Printer Interface	104.95		
RS232 Printer Interface	139.95		
High Resolution Graphics	144.95		
Shipping and handling	4.95		$4.95
		Tax**	
		Total	

* All prices quoted in U.S. dollars
** Colorado residents please add sales tax
☐ Check ☐ MasterCard ☐ Visa

Account No. _____ Exp. _____

Name

Address

City State Zip

Memopak 64K RAM The 64K RAM extends the memory of your Sinclair by 56K to a full 64K. It is directly addressable, user transparent, is neither switched nor paged and accepts such BASIC commands as 10 DIM A (9000). The Memopak 64K turns your Sinclair into a powerful computer suitable for business, recreational and educational use. No additional power supply is required.

Memopak 32K RAM The 32K RAM Memopak offers your Sinclair a full 32K of directly addressable RAM. Like the 64K Memopak, it is neither switched nor paged and enables you to execute sophisticated programs and store large data bases. It is also fully compatible with Sinclair's or Memotech's 16K RAM to give you a full 48K of RAM.

Memopak 16K RAM The Memopak 16K RAM provides an economical way to increase the capabilities of your Sinclair. And at the same time, it enables you to continue to add on other features with its "piggy back" connectors. It is compatible with the Sinclair 16K or a second Memopak 16K or Memopak 32K to give 32K or 48K of RAM respectively.

Memopak High Resolution Graphics The Memopak HRG contains a 2K EPROM monitor and is fully programmable for high resolution graphics. The HRG provides for up to 192 by 248 pixel resolution.

Memopak Printer Interface The Memopak Centronics Parallel or RS232 Interface paks enable your Sinclair to use a wide range of compatible printers (major manufacturers' printers available through Memotech at significant savings). The resident software in the units gives the ASCII set of characters. Both Memopak printer interfaces provide lower case character capabilities. The RS232 Interface is also compatible with modems.

New products coming soon Memotech will soon be introducing four new Sinclair compatible products: a high quality, direct connection keyboard, a digitizing tablet, a 16K EPROM and a disk drive. Watch for our future advertisements.

The Magazine for Sinclair users and Timex/Sinclair users

SYNC

November/December 1982 Volume 2, Number 6

DEPARTMENTS

4 **Letters**

10 **SYNC Notes**

13 **Glitchoidz Report** ..... *Grosjean*

16 **Try This** ..... *Ho, Laska, Jury*

19 **Just for Fun** ..... *Hampson, Hollandsworth, Maloff, Passler*

115 **Resources**

120 **Index to Advertisers**

SYNC AT THE DRAWING BOARD

25 **Turtle Graphics** ..... *Woodson*
A popular graphics technique

29 **Curve Plotting Graphics** ..... *Booth*
Producing graphics by formulas

39 **Meditations on a Hypotrochoid** ..... *Rogers*
Drawing pictures by formulas

41 **A Machine Code Graphics Line-Drawing Subroutine** ..... *Kopyc*
Add line-drawing to your programs

48 **Flicker-Free Four Times Normal Character Scrolling** ..... *Van Workum*
A 4K ROM machine code routine for 4x4 letters

65 **Large Letters for the 8K, 2K Machine** ..... *Carroll*
An 8K ROM machine code routine for 4x4 letters

PROGRAMMING TECHNIQUES

62 **Line Print Utility** ..... *Albrecht*
First steps to word processing

73 **Warp 81** ..... *Bonner*
Translating a 4K ROM program to the 8K ROM

80 **Renumbering Basic Statements** ..... *Wolach*
Line numbers, GOTOs, and GOSUBs

HARDWARE

87 **Your Timex/Sinclair Can Become a Remote Terminal** ..... *Rice*
Building the interfacing board

MACHINE LANGUAGE

102 **Block Transfers: Variables Transfer** ..... *Scher*
Machine language programming techniques, part 2

GAMES AND PROGRAMS

98 **Building Heat Load** ..... *Reinhardt*
Calculating options for energy conservation

100 **Random Walks** ..... *Chandler*
The graphics of random distribution

114 **A Keyboard Learning Game** ..... *Charles*
Master your keyboard and have fun

REVIEWS

36 **The Zedex Microfair** ..... *Beloff*
Report on the 4th ZX microfair

110 **You Can Review Products SYNC** ..... *Ahl*
Do you want to be a reviewer?

108 **Mazogs** ..... *Grosjean*
Game review

109 **Sea Wars** ..... *Grosjean*
Game review

111 **HOT Z** ..... *Schiller*
Software review

112 **The Quicksilva Programmable Character Generator** ..... *Wren-Hilton*
Hardware review

Staff

Managing Editor ..... **Paul Grosjean**
Contributing Editor ..... **David Ornstein**
U.K. Correspondent ..... **Martin Wren-Hilton**
Art Director ..... **Patrick Calkins**
Assistant Art Director ..... **Diana Negri Rudio**
Typesetters ..... **Karen K. Brown**
Renea Cole
Operations Manager ..... **William L. Baumann**
Personnel and Finance ..... **Patricia Kennelly**
Fulfillment ..... **Frances Miskovich**
Carol Vita
Advertising Sales Manager ..... **Karen Musmeci**

MEMBER MITA

Volume 2, Number 6

SYNC (USPS: 585-490; ISSN: 0279-5701) is published bi-monthly by Ahl Computing, Inc., a subsidiary of Ziff-Davis Publishing Company. David Ahl, President; Elizabeth B. Staples, Vice-President; Selwyn Taubman, Treasurer; Bertram A. Abrams, Secretary. 39 E. Hanover Ave., Morris Plains, NJ 07950. Second class postage paid at New York, NY 10001 and at additional mailing offices.

Subscription rates: USA: One year (6 issues), $16; two years (12 issues), $30; three years (18 issues), $42. Canada: $3 per year additional. Other foreign: $5 per year additional.

For *SYNC* advertising information, contact Karen Musmeci, *SYNC* Advertising Sales Manager, Ziff-Davis Publishing Company, One Park Ave., New York, NY 10016 (phone: 212/725-4216).

All other correspondence should be addressed to: *SYNC*, 39 E. Hanover Ave., Morris Plains, NJ 07950. In U.K., *SYNC*, 27 Andrew Close, Stoke Golding, Nuneaton CV13 6EL.

Postmaster: Send address changes to *SYNC*, PO Box 789-M, Morristown, NJ 07960.

Cover illustration by **Frank Cerulli**

letters

Comet Crusher

Dear Editor:

Chuck Dawson's Comet Crusher in *SYNC* 2:4 was interesting, but, if you have more than 1K RAM, you can add to its visual appeal. Here is a listing of the program which illustrates some of the visual effects possible (Listing 1). Using

PEEK 16396+256*PEEK 16397-16509

I came up with 1531 bytes, including line 9 and the subroutine at 350. Without these I get 1344 bytes.

I love my ZX81 with the 16K RAM and never cease to be amazed at its power. *SYNC* has really opened my eyes on that score. But, being a novice, I would like to see some very basic articles on machine code with the ZX81 in mind.

Keep up the good work.

George T. Milonas, Lt. Col, USAF (Ret.)
8130-H Bridgeport Way, SW
Tacoma, WA 98499

```
  1 REM "COMET CRUSHER" TO SAVE
GOTO 500
  3 LET SHOT=0
  4 LET HITS=0
  5 PRINT AT 0,0;
  6 FOR I=0 TO 20
  7 PRINT "
"
  8 NEXT I
  9 GOSUB 350
 10 LET H=18
 15 LET A=0
 20 LET Y=37
 25 LET X=0
 26 PRINT AT 12,1;"SHOTS: ";SHO
T;" ";AT 14,2;"HITS: ";HITS;"
 28 IF SHOT=10 THEN PRINT AT 8,
1;"YOU GOT ";HITS;" HITS OUT OF
10";TAB 1;"SHOTS FOR A SCORE OF
";(HITS/SHOT)*100;" ";TAB 1;"PER
CENT."
 29 IF SHOT=10 THEN STOP
 30 PRINT AT 18,19;"F";TAB 19;"
";TAB 19;"M"
 40 PRINT AT 20,1;"PRESS F TO
FIRE"
 50 PRINT AT 21,0;"
"
 60 PLOT X-1,Y
 70 UNPLOT X,Y
 80 LET X=X+1
 90 IF X>63 THEN GOTO 5
100 IF INKEY$="F" AND A=0 THEN
LET SHOT=SHOT+1
105 IF INKEY$="F" THEN LET A=1
110 IF INKEY$="F" THEN PRINT AT
20,1;"
"
120 IF A=0 THEN GOTO 30
130 LET H=H-1
140 PRINT AT H,19;"F";TAB 19;"
";TAB 19;"M";TAB 19;"E";TAB 19
;"
"
150 IF X=40 AND H<4 AND H>0 THE
N GOTO 200
160 IF H=0 THEN GOTO 5
170 IF H=17 THEN GOTO 50
180 GOTO 60
200 PRINT AT 3,17;"
";TAB 17
;"
";TAB 16;"
"
203 PRINT AT 0,18;
205 GOSUB 300
210 PRINT AT 10,3;"COMET PARTIC
LE DESTROYED"
215 LET HITS=HITS+1
220 FOR N=1 TO 75
230 NEXT N
240 GOTO 5
300 FOR I=0 TO 6
310 PRINT TAB 16;"
"
320 NEXT I
330 RETURN
350 FOR I=1 TO 8
360 LET Y=INT (RND*31)+1
370 IF Y=19 OR Y=20 THEN GOTO 3
60
380 LET X=INT (RND*12)+1
390 IF X=3 THEN GOTO 380
400 PRINT AT X,Y;"
"
410 NEXT I
420 RETURN
500 SAVE "COMET CRUSHE
"
510 RUN
```

Line notes:

General note: underlined words mean use the graphics mode to get the inverse letters.

7: inverse space (32); provides black backdrop.

9: May be omitted if short of memory.

26: Puts scoreboard on screen.

30: Graphics on E and 5.

50: Graphics on S (32).

110: inverse space (17).

140: Graphics on E and 5; inverse asterisk and space.

200: Graphics on QEBE; EQ.R; .WZ # E; provide debris after hit.

It's Here!

Bob Berch's

Integer BASIC COMPILER

—increase your speed 20 plus times!
—amazing 3K program includes all run time routines

commands/functions

DIM	RAND	-256 variables (two letter)
FOR/NEXT	CLS	
LET	COPY	-26 single DIM arrays
IF/THEN	SCROLL	
GOTO	AND, OR	sorry, no strings except in PRINT
GOSUB/RETURN	NOT	
PRINT	ABS	
LPRINT	SGN	-two versions
PLOT/UNPLOT	USR	16K w/code in 29-32K
POKE	RND	64K w/code in 13-16K
STOP	PEEK	
FAST	INKEY$	
SLOW	MOD(**)	
PAUSE	AT & TAB	

both versions for **$22.00 ppd** (cassette)
NY residents add 7%

Bob Berch
19 Jaques St.
Rochester, NY 14620

Now available in the United States, Britains' best-selling ZX81 workstation is a stylish yet practical plinth which will angle your TV to reduce eyestrain, conceal the leads and power supply, and if you have the 16K RAM it will hold it steady to reduce crashes. Moulded in tough black ABS complete with a ready-wired on/off switch. Looks really great!

Please order from our U.S. Agent-Jim Griner P.O. Box 1 Princeville, ILL 61559.
Manufactured By Peter Furlong, Products Unit 5, South Coast Road Industrial Estate. Peace Haven, Sussex, England Tel: (07914) 81637

FIRST TALK TO MINDWARE.

If you're writing software for the Timex-Sinclair personal computer, you ought to talk first to the software publishing company that will do the most for you and your program. Here's six good reasons why good programmers come to us first:

1. MASS MARKETING CAPABILITIES.
The Timex-Sinclair computer market is no longer a mail-order, hobbyist business. We have the marketing resources to put your titles in more than 25,000 retail outlets, including chain stores, mass merchandisers, audio centers and PX's.

2. VERTICAL MARKETING CAPABILITIES.
At the same time, we *also* sell actively to the kind of specialized audiences who can't be reached through mass market outlets. If you've written the definitive program for machine shop estimators, we know where to sell it.

3. BETTER ROYALTY TERMS.
Since we expect to buy the best in Timex-Sinclair software, we expect to pay the best in royalties. And we pay *promptly* and *frequently*—a policy that, sadly enough, many other publishers seem to feel is unnecessary.

4. "QUICKLOADING".
Every title we sell now incorporates our unique "Quickload" algorithm. "Quickload" enables your program to load at a rate six times faster than other Timex-Sinclair software. That kind of special feature means bigger sales—and bigger royalties.

5. PROFESSIONAL PACKAGING AND PROMOTION.
We take our titles seriously. We're willing to invest in good graphics, good documentation, good advertising. You'll be proud to show off your work, because we are too.

6. WE'RE NICE TO DEAL WITH.
Mindware isn't a big, impersonal corporation with layers of bureaucrats to penetrate. We know our leadership in software depends on finding the very best authors—and keeping them. So we try to respond quickly and honestly, and treat you with respect.

We can't promise to publish every program you submit. But if you've got a title you feel is a real winner, our advice is simple:

FIRST TALK TO

MINDWARE

15 Tech Circle Natick, Mass. USA 617-655-3388

220: For a pause without jerkiness of PAUSE.

300: Erases comet and rocket.

310: 5 inverse spaces.

350-420: See line 9; may be omitted if short on memory; provides a few stars in the sky.

370, 390: Keep clear path for comet and rocket.

400: Inverse +.

DEF

Dear Editor:

Jon Passler's article on DEF (*SYNC* 2:4) is very helpful, but the action can be speeded up a bit by adding as follows:

1K RAM:
102 PRINT AT 0,0;A$
105 FAST

16K RAM:
175 FAST
200 delete
300 delete
325 SLOW

For some reason my machine produced an "INTEGER OUT OF RANGE" code for line 160 in the 16K program—so I substituted.

David M. Hoke
Apt. D4, Eastampton Gardens
Mt. Holly, NJ 08060

Draw It

Dear Editor:

In the Draw It program in *SYNC* 2:4 lines 60, 70, 80, and 90 can be deleted and the following lines put in:

60 LET X=X+(INKEY$="8")-(INKEY$="5")
70 LET Y=Y+(INKEY$="7")-(INKEY$="6")

Robert Jorgenson
3814 Coleman Ave.
San Diego, CA 92154

Strong KBD Signals

Dear Editor:

I would like to publicly thank Herb Hornung (Double H Electronics, 195 Lelani, San Antonio, TX 78242) for his hardware tip concerning strong signals from KBD 0-4 (*SYNC* 2:4). I had been having keyboard troubles with the kit from the time I put it together. This was one of the reasons I purchased a keyboard from Herb. At that time he made some recommendations which helped quite a bit. Examination showed that a very strong signal from KBD 0 would often "crash" the system when a key in that circuit was used. Herb's article, personal correspondence, and the substitution of 6.8k ohm resistors for the Sinclair resistor pack straightened out all the problem I was having. I highly recommend the Double H keyboard for those who have trouble getting their fingers around the membrane keyboard.

Lawrence A. Kelly
28 Countrywood Dr.
Morris Plains, NJ 07950

List Learning

Dear Editor:

I am writing to express my thanks to James John Hollandsworth for "List Learning with the ZX81" *(SYNC* 2:5). The program ran beautifully and my eight year-old enjoyed it. He has already started to learn the states and their capitals, and he gets to use Dad's computer to boot!

There were some parts of the program that I changed slightly to make it run smoother. When the program that I changed slightly to make it run

LIMITLESS EXPANSION FOR SINCLAIR/TIMEX

FLOPPY DISC INTERFACE $179 * 1-4 DRIVES, ANY SIZE * SINGLE/DOUBLE DENSITY * INDUSTRY STANDARD IBM FORMAT * ON BOARD DOS IN ROM
RIBBON CABLE CONNECTIONS FOR MAXIMUM RELIABILITY
1000 TIMES FASTER THAN CASSETTE

5.25" DOUBLE DENSITY FLOPPY DISC DRIVES $189 EA.
POWER AND CABLES FOR 2 DRIVES $69 FOR 4 DRIVES $79

STD BUS INTERFACE $99 COMPLETE WITH RIBBON CABLE
CHOOSE FROM 300 PERIPHERAL INTERFACES, 60 MANUFACTURERS

CENTRONICS PRINTER INTERFACE $119 COMPLETE WITH PRINTER CABLE, SOFTWARE IN ROM

DIRECT VIDEO MODIFICATION $25 WE INSTALL $15 YOU INSTALL

WORD PROCESSING SOFTWARE PACKAGE $15 MACHINE LANGUAGE

AERCO
BOX 18093 AUSTIN TX 78760-8093
(512) 385-7405

dk'tronics

ZX 80/81 SPECTRUM Hardware Software

ZX KEYBOARD

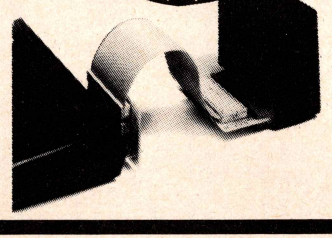
The case is large enough for both the computer (81 or Spectrum) and the power supply to fit inside. **Requires no soldering**

Fully cased with numeric pad $81
Uncased with numeric pad $54
Case $27

SPECTRUM MEMORY UPGRADE TO 48K $71.90

NEW FROM dk'tronics

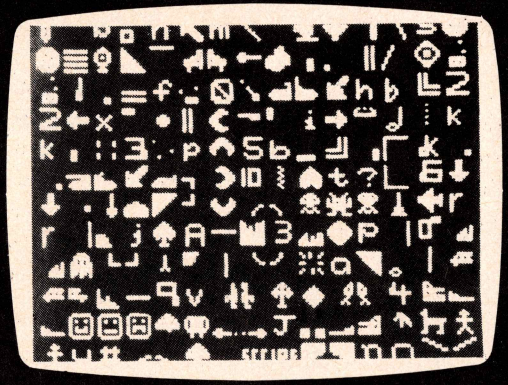
(A) 16K Ram Massive Add On Memory
Fully assembled and tested **$35.90**
(B) 64K Memory Expansion **$89.90**
(C) 4K Tool kit full of utilities to aid the programmer in constructing and de-bugging E. Prom version for use with graphics Rom **$17.93**
Cassette version **$12.50**
(D) Flexible ribbon connector (as illustrated) **$18**



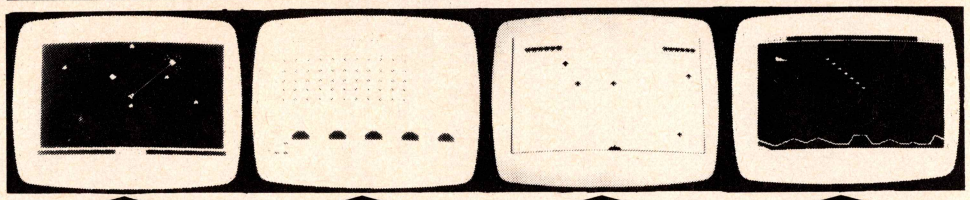
The DK Graphic module is our latest ZX81 accessory. This module, unlike most other accessories fits neatly inside your computer under the keyboard. The module comes ready built, fully tested and complete with a 4K graphic ROM. This will give you an unbelievable 448 extra pre-programmed graphics, your normal graphic set contains only 64. This means that you now have 512 graphics and with their inverse 1024. This now turns the 81 into a very powerful computer, with a graphic set rarely found on larger more expensive machines. In the ROM are lower case letters, bombs, bullets, rockets, tanks, a complete set of invaders graphics and that only accounts for about 50 of them, there are still about 400 left (that may give you an idea as to the scope of the new ROM). However, the module does not finish there; it also has a spare holder on the board which will accept a further 4K of ROM/RAM. This holder can be fitted with a 1K/2K/RAM and can be used for user definable graphics so you can create your own custom character sets.

$53.91

4K Graphics rom



SOME OF THE GRAPHICS NOW POSSIBLE ON THE ZX81



★ASTEROIDS ★SPACE INVADERS ★CENTIPEDE ★DEFENDER

16K GRAPHICS ROM SOFTWARE $8.91

dk'tronics

Send off the coupon today, or telephone Great Yarmouth, England (01) 44 493 602453 for our answering service, available 24 hours a day, 7 days a week, quoting your Mastercard or Visa number. (please add on $9 for post and package)

23 Sussex Road,
Gorleston,
GREAT YARMOUTH,
Norfolk. ENGLAND

MasterCard BARCLAYCARD VISA

Please state type of machine, which ROM memory size, quantity and price when ordering.

Please send me ..... @ $ .....
Please send me ..... @ $ .....
Please send me ..... @ $ .....
Please send me ..... @ $ .....
Please send me ..... @ $ .....
Please add on $9 for P/P. I enclose $ .....
Name .....
Address .....

Cheques/I.M.O. payable to D.K.Tronics

smoother. When the program ws put into "Review" mode, the screen had an annoying blink that was rather distracting. The reason for the blinks was the PAUSE statements used.

The solution was to replace them with FOR/NEXT loops as follows:

210 (change the zeros to 1's)

217 IF Z<1 or Z>9 THEN GOTO 215

235 FOR R=1 TO Z*10

236 NEXT R

237 POKE P, Q

Use the line content of 235-237 to make three more loops:
250-252, 280-282, 295-297.

Again, special thanks to James Hollandsworth for this very useful learning tool.

K.R. Peters
14 Meade Ct., #2
Fox Lake, IL 60020

Ed.—The use of the PAUSE routines in "Listing Learning" indicates that the program may be used on the ZX80 (8K ROM). In our last issue we noted that programs for the ZX81 and the ZX80 (8K ROM) are virtually identical except that certain types of displays on the ZX80 (8K ROM) need the PAUSE routines as a substitute for the SLOW mode. If you have the ZX81 or the T/S 1000, you can substitute the FOR/NEXT loops, but you can also just omit the PAUSE routines.

LET YOUR ZX81/TIMEX 1000 WORK FOR YOU!

PERSONAL AND BUSINESS PROGRAMS:
Are on cassette, are menu driven and save on tape automatically.

SALES FILE 16K:
Will hold up to 125 products with their wholesale and retail prices. Separates and totals wholesale and retail prices and shows the amount of profit in up to 25 different accounts. - Records inventory automatically or may be changed manually. - Keeps a running total of sales tax. Has a cash register mode which will identify, total, and add sales tax while it automatically keeps records for your bookkeeping.

SALES FILE 64K: Same as above except it will hold up to 600 products for up to 100 accounts. **Specify 16K or 64K**
*** A must for any small business. *** ---------- $19.95

CHECKING 16K:
Lists up to 25 deposits showing amount of deposit and date entered. Lists up to 80 checks and displays check number, date and to whom check was written. - Lists by account the total of the checks written to any given account. - Keeps a running total of checks written and the balance left in your account. - Search for a check by check number, name, date or amount to find any check quickly.
*** Great for tax records. *** ---------- $9.95

MAILING LIST 16K:
Holds up to 100 names, addresses and telephone numbers. - Search by name, city, zip code, or phone number to find any address or phone number quickly. - Lists all names, changes or deletes.
*** Christmas cards are a snap with this program. *** ---------- $9.95

INVENTORY (1) 16K:
May be used for everything from keeping an accurate inventory for your business, to your personal record collection. - Holds up to 150 items with comments for each. - Comments may be used for serial numbers, dates, prices or location. - List all items, search for a single item, change or delete any item. - *** Everyone should have an inventory of household items in case of fire or theft. ***

INVENTORY (1) 64K: Same as above with up to 750 items.
*** Specify 16K or 64K *** ---------- $9.95

INVENTORY (2) 16K: Same as above without comments.
Holds 300 items. ---------- $9.95

EDUCATIONAL PROGRAMS: On cassette and menu driven. Require 16K.

MATH QUIZ:
Allows user to choose addition, subtraction, multiplication, or division for up to 50 problems, with difficulty levels from 1 to 6. Each problem may be listed with the correct answer.
*** Great for home or class room *** ---------- $9.95

FLASH SPELLING:
Enter up to 50 words for your child to learn to spell. - You determine how long you want the word to be flashed. - Misspelled words may be listed.
*** Word files may be saved on tape. *** ---------- $9.95

Send certified check or money order to:
Indiana residents add 4% sales tax.
Add $1.00 per tape shipping.
Dealer inquiries invited.

HEATH COMPUTER SERVICES
950 East 52 South
GREENTOWN, IN 46936
Phone 317-628-3130

Pantry Inventory

Dear Editor:

I thoroughly enjoyed Dr. Justham's "Pantry Inventory" *(SYNC* 1:6). I have expanded upon it, and I would like to share a more efficient search routine using the LEN command. Rather than use up memory space by creating a separate array M$ in line 3044 with which to compare the "item" sought (C$), compare C$ to the original array I$ (B) directly as follows:

3040 INPUT C$

3050 FOR B=1 TO 150

3060 IF C$=I$ (B) (1 TO LEN C$) THEN GOTO 3100

3070 NEXT B

Using the same method, it is possible to expand the search routine to search records internally, i.e., looking for strings within a heading and not limited to the first characters within that heading:

FOR B$=1 TO 150

FOR J=1 TO (LEN I$ (B)-LEN C$+1)

IF C$=I$ (B) (J TO J+(LEN C$-1)) THEN GOTO 3100

NEXT J

NEXT B

If you have a larger number of records, this search may take a while, but it is very thorough. Thanks for your highly entertaining and educational magazine. I look forward to my next issue!

Jeff Hino
929 NW 28th
Corvallis, OR 97330

Lunar Lander

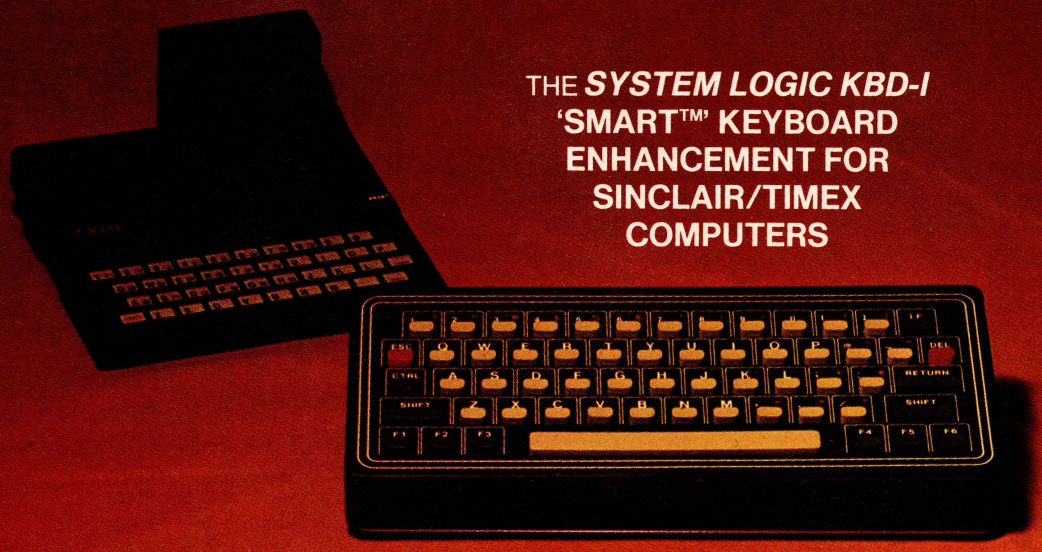
Dear Editor:

If you have more than 1K RAM, you can modify Chuck Dawson's Lunar Lander (*SYNC* 2:1) with the lines given below which will indicate a safe landing, your pilot's rating, and the reason for the rating.

Dick Bloom
PO Box 91
Cloudcroft, NM 88317

```
  40 IF NOT H AND V<-100 THEN ST
OP
  41 IF H THEN GOTO 11
  42 IF NOT H AND V>-100 THEN PR
INT "SAFE LANDING"
  43 IF NOT H AND F<6000 THEN PR
INT AT 20,16;"CMNDR"
  44 PRINT "GOOD FUEL USE"
  45 IF NOT H AND F<4000 THEN PR
INT AT 20,16;"CAPT."
  46 PRINT "FAIR FUEL USE"
  47 IF NOT H AND F<2000 THEN PR
INT AT 20,16;"PRVT"
  48 PRINT "NEED TO CONSERVE FUE
L"
  49 IF NOT H AND F<1000 THEN PR
INT AT 20,16;"RESCHOOL"
  50 PRINT "TOO MUCH FUEL USED
."
  51 STOP
```

SINCLAIR/TIMEX USERS
NOW SYNERGISTIC OFFERS YOU THE 'SMART™' CHOICE DESIGN



THE ***SYSTEM LOGIC KBD-I***
'SMART™' KEYBOARD ENHANCEMENT FOR SINCLAIR/TIMEX COMPUTERS

All units shipped with silk screened graphics comparable to those of Sinclair/Timex machines. We regret these were not available for *this* advertisment.

SYSTEM LOGIC — KBD-1

The System Logic KBD-I Keyboard enhancement offers Sinclair ZX-80, ZX81 and Timex TS-100 users an intelligent keyboard peripheral.

A KBD-I allows an increase in user throughput by as much as 70% while reducing fatigue factor errors.

Now enter data and programs quickly without having to 'hunt' for key contacts. Each key produces 'tactile' feedback in addition to employing right-and left-hand 'smart' shift keys. The KBD-I remains in the shifted mode with a *single* keystroke, while exiting from the shifted mode with a second (left or right!) keystroke entry.

The KBD-I simplifies integrating your computer system into a professional or business application. The compact size of the KBD-I permits easy portability, its brushed aluminum black anodized cabinet is a cautious blend of attractive design and the highest quality engineering and manufacturing techniques.

SMART ™ features
Patent Pending

FEATURES

- 'SMART™' shift function
- Tactile feedback
- 59 keys (with left and right shifts)
- Standard (QWERTY) typewriter format
- Silk screen labels compatible with Sinclair/Timex keyboard
- Compact design
- Rugged yet attractive black anodized aluminum cabinet
- Simple installation
- Custom engineered for Sinclair/Timex computers
- Auto-repeat function (fast/slow modes)

SPECIFICATIONS

Contact resistance: 20Ω @ 1mA
Contact rating: 1.0V/A
Contact bounce: ⩽5.0mSec.
Switch life: 5.0×10^6 operations typical
Switch force: <9.0 oz.
Switch travel: .015 in.

MAIL ORDER TO:
SYNERGISTIC DESIGN
P.O. BOX 411023
CHICAGO, ILLINOIS 60641

*Illinois residents include 6% sales tax.

	PRICE	QTY.	AMT.
SYSTEM LOGIC KBD-I KEYBOARD	**$85.95 ***		
Shipping and handling (per unit)	**$ 4.95**		**$ 4.95**
Money order or check		TOTAL	

NAME_____

ADDRESS_____

CITY_____ STATE_____ ZIP_____

sync notes

SYNC at the Drawing Board

Our theme section this issue is "SYNC at the Drawing Board." This selection of articles illustrates some of the techniques that can be used to generate graphics displays. If the number of manuscripts we receive means anything, producing a graphics display is among the most popular challenges of computer programming.

All of us can draw a picture on paper (some better than others, of course). We envy those who can draw real pictures with a few movements that seem so effortless. Now the computer has given us all another tool for making pictures and the challenge of mastering the display screen.

Simply filling the screen with a graphics display is one of the first programming efforts. Such a display can be produced through a program involving a random element such as several of our "Try This" entries have done. These brief programs can fill the screen with constantly changing patterns. However, we have no control over the display once the program begins running. The greater challenge is to produce a display that shows what we want whether a picture or some kind of graph or design. The ultimate display is one that the user can interact with and that will modify itself in response to user input. The games with moving graphics are prime examples of this type.

Graphics are fun for their own sake. To be able to control the graphics capabilities to produce hi-res displays is the programmer's reward. In order to develop displays with moving graphics and high economy in programming, we need to learn something about machine language programming. However, many are also interested in using graphics as part of a larger program to display data, liven up programs, provide a challenging game, or just have the fun of creating a display.

The programs in our theme section illustrate how mathematical formulas can be used to provide graphics, how to get the smooth graphics that resemble movie or TV pictures by the use of machine code, and how to use such programs as subroutines within larger programs. We hope that these articles, along with our "Just for Fun" entries, will challenge your imagination and give you some tools for your own programming.

Theme Sections Coming

Our next issue will feature "SYNC in the Home Office." Other projected themes include "SYNC on the Job" which will show some of the ways Timex/Sinclair owners are using their computers for their jobs, "SYNC at the Concert" which will show some of the musical capabilities, "SYNC at the Arcade" which will put together some arcade type games.

Other theme sections will depend on the availability of articles to support the setion. So if you have a possible article to support one of these themes, we want to see it.

ZXPRESS™ –

Non-Trivial Solutions' new Integer Basic Compiler! Now you can write programs in rapid time!

- compiles ZX-81 Basic source code to machine language: write and debug in a subset of ZX-81 Basic: compile when it's right
- increases the speed of the ZX-81 20 to 50 times
- 208 regular variables, 26 dimensioned variables; variables are 16 bit two's complement integers
- compiled code can be stored in REM or in 2000H to 3FFFH address segment, if available
- the source code can be located anywhere and the position of the compiled code can be selected, allowing you to write a long program, comit in pieces, and link the pieces
- 4 functions -- PEEK, RND, USR, IN KEY$
- 14 key words
- 16K or more RAM
- $29.95
- Still available:
  - Letter Raiders & Life with Palette
    - challenging games
      - $9.95 each

(Copyright 1982 NON-TRIVIAL Solutions)

	QUANTITY	PRICE	TOTAL
ZXPRESS		$29.95	
Letter Raiders		$9.95	
Life with Palette		$9.95	

☐ Check enclosed Charge my ☐ Mastercharge ☐ Visa
Card No. _____ Exp. Date _____
Signature _____

NON-TRIVIAL SOLUTIONS
P.O. Box 2941
Amarillo, Texas 79105
(806) 376-5723

Britain's leading Software house means ONCE BITTEN...
ADVENTURES:
Dictator $20.00
Damsel and the Beast $15.00
House of Gnomes $16.00
ARCADE:
Mazogs $22.00
Invaders $10.00
Space Trek $12.00
UTILITIES:
ZXAS $12.00
ZXDB $15.00
ZXTK $14.00
And many, many more.
All prices include postage and packaging.
ALKBYTE SOFTWARE
100 The Albany, Old Hall Street, Liverpool L3 9EP
England, U.K., The Earth.

BYTE-BACK modules

64-K MEMORY $119.95 KIT

WIRED and TESTED $129.95

IN STOCK!

SAME DAY SHIPMENT!

WHY PAY MORE?

BYTE-BACK'S M-64 extends the memory of your ZX81 or Timex-Sinclair 1000 to a full 64-K. It's user transparent. It plugs directly into the back of the ZX81 and has an expansion port to allow you to still use a printer. No extra power supply is required. It has all standard features **plus** the area from 8-16-K can be switched out in **2-K** increments for memory mapped peripherals, PROMS, etc. Same proven reliability as our M-16 with thousands in use.

INSTANT INFORMATION WITH BYTE-BACK'S MD-1 MODEM

IN STOCK

MODEM *only* **$119.95 KIT**

WIRED and TESTED $149.95

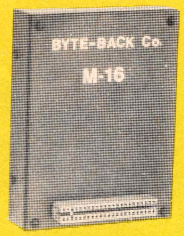
Use your phone to connect your "LITTLE" ZX81 to the "LARGEST" computer networks in the world. With **BYTE-BACK's MD-1 MODEM** connected all you do is dial a phone number (usually local), press a few keys and watch the data appear on your TV screen. (Software is included) This **MODEM** can be used in either the "originate" or "answer" mode with selectable baud rate.

You can have immediate access to:

UNIVERSITY COMPUTERS, DOW JONES, UPI, AND MORE !

As an extra bonus an RS-232 port is provided to allow you to drive all standard RS-232 peripherals. (75 to 9600 Baud)

EXPAND YOUR 16K SYSTEM (M-16) $59.95 KIT



WIRED and TESTED $69.95

If you have a Sinclair 16K RAM module and need more memory, expand it to 32K and beyond by using **BYTE-BACK M-16 MEMORY MODULES.**

You can't connect two Sinclair 16K RAM modules together, but you can connect one Sinclair 16K and one or more **BYTE-BACK 16K** modules to get all the memory you need.

THOUSANDS IN USE WITH PROVEN RELIABILITY

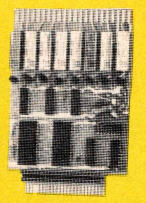
IN STOCK — SAME DAY SHIPMENT

BYTE-BACK'S BB-1 CONTROL MODULE

$59.00 KIT *In Stock!*

WIRED and TESTED $69

- **8 Independent Relays** *(with LED status indicators)*
- **8 Independent TTL Inputs** *(with Schmitt trigger buffers)*



- By using a single POKE command you can change and latch the status of each of the 8 relays.
- Your **ZX80/1** can read the status of all 8 inputs by the use of a single PEEK command.
- A comprehensive manual is included that has complete application details.

RS-232 Module $59.95

WIRED and TESTED $69.95 IN STOCK

Allows you to connect ZX81 to all RS-232 printers & terminals.

ALL MODULES CARRY 90-DAY WARRANTY

TRY BYTE-BACK MODULES FOR 10 DAYS WITH NO OBLIGATION

Remember with:* BYTE-BACK *modules you are NOT limited to using only one module at a time!

☐ M-64 Kit	$119.95	☐ M-16 Kit	$59.95
☐ M-64 Wired and Tested	$129.95	☐ M-16 Wired and Tested	$69.95
☐ M-64 Blank PC Board	$19.95	☐ M-16 Blank PC Board	$19.95
☐ BB-1 Kit and Manual	$59	☐ Modem Kit	$119.95
☐ BB-1 Wired and Tested and Manual	$69	☐ Modem Wired and Tested	$149.95
☐ BB-1 Blank PC Board and Manual	$29	☐ RS-232 Module Kit	$59.95
		☐ RS-232 Module Wired and Tested	$69.95

Shipping and Handling $4.95

ORDER PHONE (803) 532-5812 **Bill My** ☐ Visa ☐ MasterCard

Exp. Date _____ Card No. _____

Name _____

Address _____

City/State/Zip _____

Mail To: **BYTE-BACK CO. • Rt. 3, Box 147 • Brodie Rd. • Leesville, S.C. 29070**

VISA

CHECKS

MasterCard

BYTE-BACK CO.
RT. 3, BOX 147 • BRODIE RD.
LEESVILLE, S.C. 29070
Ph. (803) 532-5812

The ZX81 BASIC Programming Manual

If you make a reference to the manual that you received with your Sinclair ZX81 or 8K ROM in any article or correspondence sent to *SYNC* be sure to specify the edition. There are four editions of the book available now: the first and second British editions and the first and second American editions. There are some differences.

SYNC Is Growing! You Can Help!

The first nine issues of *SYNC* gave readers a magazine of 48 pages plus covers with about 30-35 pages of editorial and 12 to 15 pages of ads. Volume 2:4 jumped to 80 pages; Volume 2:5 to 100 pages. This issue has 124 pages showing increases in both editorial and ad content.

To maintain this size magazine we need your help in two ways:

1) We need articles and contributions from authors. So if you have an article of possible interest to *SYNC* readers, we would like to take a look at it. If you have been thinking about writing something, drop us a note telling us what you have in mind. We will tell you whether we would like the idea developed and in what direction to increase its usefulness to our readers. If you missed "Writing for SYNC" in *SYNC* 2:1, send a self-addressed stamped envelope for a copy. This will help you put your article together. If you are interested in writing reviews, see p. 110 below.

2) We need advertisers. If you have a product, please contact Karen Musmeci, our new Advertising Sales Manager (see the contents page for details). If you have bought a product whose manufacturer or distributor has not advertised in *SYNC,* please plant a suggestion. ■

Glitchoidz Report

ZX Destroyer (2:4)

The author suggests the following changes and clarifications:

Figure 6:

1 REM: 6th line down, last character is U. Last line, change last F to E.

2 REM: 1st line, change C (5th character) to A; change 2 (4th character from right) to 1.

30 REM: 1st line, change 4 (5th character) to 5.

Figure 7:

Line 90: changee 243529 to 243473; 488940 to 488758; 612608 to 612426.

Line 110: change 733561 to 733408.

Figure 8:

Do not enter lines 10-35.

Author's note: I have a SLOW converter from MicroAce which apparently has a different character sync. This causes small lines on some characters on some computers. POKE 16547,1 might help. Some problems with the alien's laser can be corrected for those who have the program already entered by: POKE 16748,13; POKE 16764,149; POKE 16779,140.

Just for Fun (2:5, p. 20)

The first character of the following carry-over lines was lost. Add at the beginning of the carry-over:

Zap: Line 40: a period.

Catch 25: Line 120: a comma.

Block Transfers (2:5)

p. 71, Figure 2:

Line 230: Delete.

Line 260: Add a ; at the end. ■

IT'S HERE!!

The keyboard you have been waiting for!

A LARGE 60 KEY TACTILE FEEL KEYBOARD (MEASURES 10" x 4") THAT PLUGS INTO THE SAME CONNECTORS AS EXISTING KEYBOARD ON YOUR ZX81 OR TIMEX SINCLAIR 1000. IT HAS ALL SILKSCREENED LEGENDS IN 3 COLORS ON THE BASE; MOLDED LEGENDS & GRAPHICS ON KEY TOPS; 8 AUTOMATIC SHIFT KEYS (NO SHIFTING REQUIRED) FOR EDIT, DELETE, SINGLE & DOUBLE QUOTES, COLON, SEMI-COLON, FUNCTION & STOP; 5" SPACE BAR; 2 SHIFT KEYS; NUMERIC KEY PAD.

ONLY $70.00

MASS. RESIDENTS ADD 5% SALES TAX
SHIPPING & HANDLING $4.00/UNIT

ENCLOSURE AVAILABLE. QUANTITY DISCOUNTS. WE ACCEPT MC/VISA. PLEASE INCLUDE #'S, EXP. DATE AND SIGNATURE. FOR MORE INFORMATION SEND SASE. SEND INQUIRIES, CHECK OR MONEY ORDER TO: **E-Z KEY**
SUITE 75A
711 SOUTHERN ARTERY
QUINCY, MA 02169

PRACTICAL ZX-81™ SOFTWARE

ZX-PANDING LTD.

ZX-81™ Not Just For Games Anymore!

ZX-PANDING, LTD., an American company, uses the tremendous ZX-81™ data handling capabilities to make our daily tasks easier. Programs are on cassette, thoroughly tested, with easy-to-read printed instructions, written in BASIC to allow tailoring to your special needs.

1. **YOUR SPECIAL DAY**—1K—Good example of using successive equations to answer a practical question. Enter *any* date in history, and ZX-81™ will tell you the day of the week on which it occurred. Useful in many fields and a great ZX-81™ demonstration. . . . . .ONLY **$3.75***

2. **CLOCKS AND TIMERS**—1K—A digital clock (standard or military time), a count-up timer (for telephone calls), and a count-down timer (useful in cooking). Another great ZX-81™ demonstration .ONLY **$3.75***

3. **ANYPOINT PLOTTER**—1K—Crunches any data to allow graphing of any positive data points: stock prices, temperature, experimental data, etc. . . . ONLY **$3.75***

ALL 3 FOR ONLY $8.75!

4. **CHECKBOOK, INCOME TAX AND BUDGET ORGANIZER**—16K A powerful yet easy to use finance program—10 jobs in menu driven format. Checks and deposits are totaled and itemized under desired categories for budget planning and income tax preparation. Makes checkbook balancing easy. Ninety transactions manipulated at one time with 16K . .ONLY **$13.75***

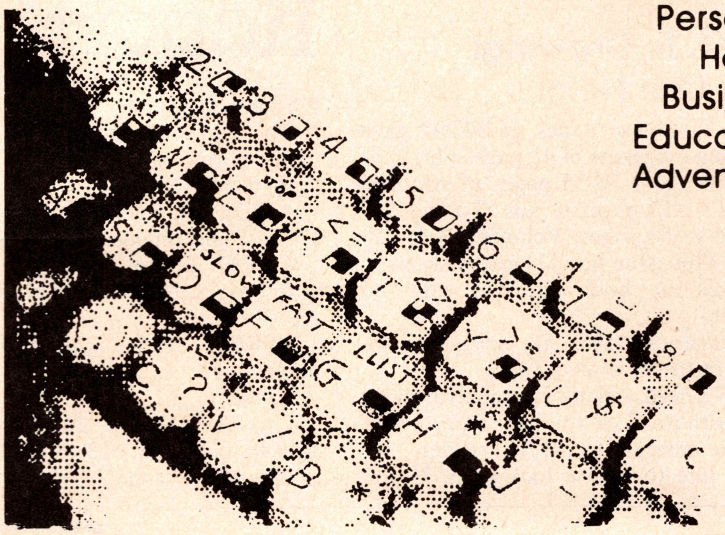
ZX-PANDING, LTD.
P.O. BOX 25
NEWTON, NC 28658

Free catalog with self addressed stamped envelope.
*ALL orders please add $1.25 to total order to cover POSTAGE AND HANDLING. (Foreign orders add $2.00 to cover air costs. Your payment must be in a U.S. dollar draft payable to U.S. bank.)

New Releases

TIMEX 1000* / sinclair ZX-81*

Personal Computer Software



Personal
Home
Business
Education
Adventure

TS/ZX ASCOM
(operates with 1K on board ram of the TIMEX or SINCLAIR) $24.95
Now the real power of the computer is at your finger tips. Our new software routine will operate the ZX-81 or TIMEX 1000 as a terminal... Program requires our parallel/serial board and your modem. Converts CLIVE code to full ASCII and allows you to have dial access to the computer world for data bases or just computer to computer communications.

INTERFACE BOARD SERIAL AND PARALLEL $99.95
Super new product. This interface board brings the world of TIMEX and SINCLAIR personal computers into the real world of computers. Features:

- Centronics Standard Parallel Interface to Printers, etc. includes handshaking.
- RS 232 Serial interface with full specifications and input or output.
- On board driver routines in 2716 EPROM
- Switch selectable BAUD rate for high speed (9600) communications

When the board is used in connection with our TS/ZX ASCOM software then the user can access any of the many network ON-LINE services or communicate directly with other computers.

LOW BUDGET 16K RAM PACK $44.95
Just arrived in time for the gift season, a low priced 16K ram pack. Standard features of our other packs, but it is shipped without the final case. Guaranteed not to let you down and makes memory affordable.

TS/ZX PAC MAN (16K)
Adventure Arcade Style $19.95
Fantastic re-creation of the famous arcade game now on the Timex or Sinclair personal computer. FAST MOVING and requires a lot of skill. If you win at the first level then there is more to follow. Degrees of difficulty on a full size screen maze, with PAC MAN type graphics and moves. Don't miss it.

COMP-U-SHARE (16K)
PERSONAL HOME FINANCE $24.95
Excellent program that allows the user to maintain an up to date record of his portfolio. Stocks, Bonds, Funds or other financial investments. Developed by a professional for his own use. Monitor your results or run a forecast of expected results. Includes P/E ratios, dividends, etc. User guide included.

PROPERTY MANAGER (16K)
BUSINESS or PERSONAL FINANCIAL $24.95
Our accountant believes that this program allows your system to be tax deductible as an individual, we will advise upon further notice.

Property owners or Managers will find this an extremely valuable tool. Provides for any combination of 10 units in 2 buildings or 2 units in 5 buildings per program. If you have more than 10 then just run a new copy of the master file. The program tracks each unit for RENT, up to 15 variable expense categories, and 15 fixed expense lines, all for a full year. That's right 12 months of data including late payments, and optional save routines for the ZX-99.

CASH FLOW FORECASTER and BUDGET ANALYSIS (16K)
HOME or BUSINESS $19.95
Brand new financial utility for use at home or in the office. Keeps detailed records for twelve months in the three major categories. INCOME, FIXED and VARIABLE EXPENSES PLUS LOAN BALANCE OR LINE OF CREDIT. Provides the user with the ability to forecast or track the history of his cash flow.

INVENTORY CONTROL AND STOCK ANALYSIS (16K)
HOME or BUSINESS $19.95
The first in a series. This program operates as a stand alone control or it will operate with the ZX-99 Tape control system for file handling. Features include stock control of units and of values, with separate routines for receipts and returns or sales and shipments. Special routine for adjustments in units or values. Program uses average cost for inventory value and shipments. Allows the user to SORT by code or alpha name. Quick access to stock levels. New feature will allow the user to automatically expand the files for 32 or 64K ram packs.

data-assette

THE LOGICAL EXTENSION

Tape Controllers and Printer Interface
Just look at these fantastic features
• ZX-99 automatic tape control of up to four cassette recorders as input or output under full software control. Printer interface for any RS 232 serial printer giving the user access to all 132 characters of ASC II characters. Data retrieval word processing for real mini-computer capabilities. Plus! Automatic tape to tape copy, tape block skip and diagnostic assistance.
• Tape load interface. Say goodbye to the load problems associated with the system. The tape loader allows the user to test and pre-set the cassette recorder to the exact sound level expected by the Timex or Sinclair. No more five minute load with unsatisfactory results. Unit has LED lights which tell the user when the recording level is correct or when the sound needs modifying. A real big time saver.

Ram Packs 16K, 32K or 64K
Expands the memory available from 2K up to a maximum of 64K, but with a real difference. Our 32K also comes in a piggyback version that allows the user to plug in his 16K and have a full 48K of memory. Finally you can buy the 32K piggyback version now and add another 32K later for a full 64K in the end. Plugs directly into the computer and does not require any additional power source. Features a LED light to signal when the ram pack is operational.

Keyboards
The Klik and Executive. Both units offer unique features. The Klik is full replacement for the "Touch Sensitive" Timex keyboard. Features include separate space key, plugs into your Timex, no special case required, positive feedback from key depressions. Executive keyboard is the ultimate in the ZX-81 Timex/Sinclair range. It is a full size with special features like automatic repeat key, full length space bar, and "beeper sound" operated with an on/off switch, plugs into the computer or we will retrofit it for you.

Data-assette offers Timex and Sinclair owners something new.
Users may up-grade gradually as their needs change. Each unit is fully tested and carries our 90 day guarantee. Purchase the full suite and you have a mini-computer with real data processing. Our product range allows the intelligent user to expand his system as his needs change. Finally all of our software has been specially selected to offer the user a tested and reliable product that has been developed with two important criteria: user friendly and hardware compatible or selectable. Now all of this and our full range of software (over 50 choices) is available from your local Timex computer dealer or store. So come on in and try out the latest logical extensions.

PRODUCT NAME and CODE	UNIT PRICE	QTY.	TOTAL VALUE
Ram-Pack 16K	$ 49.95		
Ram-Pack 32+K	$109.95		
Ram-Pack 64K	$149.95		
Ram-Pack 32K	$ 99.95		
Tape Ctl. ZX-99	$149.95		
Keyboard Mini	$ 75.00		
Keyboard Exec	$ 95.00		
Tape Load Int.	$ 39.95		
Print Bd Ser/Par	$ 99.95		
TS/ZX Pac Man	$ 19.95		
Comp-U-Share	$ 24.95		
Property Mgr.	$ 24.95		
Forecast/Budget	$ 19.95		
Inventory Ctl.	$ 19.95		
TX/ZX ASCOM	$ 24.95		
Shipping/Handling			$4.95
TOTAL ORDER			

Data-Assette has over 50 software programs in its library, and we are adding more each month. If you wish to see our catalogue or join our mailing list, just send $2.50 which will apply towards your first order.

Information and product spec sheets may be obtained by mail, or phone our HOT-LINE 800-523-2909; in Penna 215-932-4807.

PLEASE RUSH MY ORDER TO:

Name _____

Address _____

City _____ State _____ Zip _____

Charge To: VISA ☐ Master ☐

Account Number _____

Expiration Date _____

Signature _____

Send to: Data-Assette (sy-3)
56 South 3rd St.
Oxford, Pa. 19363

try this

4K ROM

Type in the program listing below. Then RUN the program and watch the results. The program takes about 15 seconds to finish RUNning. Then try different values for lines 50 and 70. The values 8 and 136 produce an interesting display.

Our thanks to:
Joseph Ho
297 Gibson St.
Fredericton, N.B.
Canada E31 4E7

```
 10 FOR Y=-10 TO 10
 20 FOR X=-10 TO 10
 30 IF ABS(Y)=(ABS(Y)/2)*2 AND#
ABS(X)<ABS(Y)+1 THEN GOTO 70
 40 IF ABS(X)=(ABS(X)/2)*2 AND#
ABS(Y)<ABS(X)+1 THEN GOTO 70
 50 PRINT CHR$(0);
 60 GOTO 80
 70 PRINT CHR$(128);
 80 NEXT X
 90 PRINT
100 NEXT Y
```

8K ROM

In this issue we have two little programs that are similar in the results, but different in the method of achieving them.

Type in the following line:

```
1 REM Y  GOSUB X PRINT "■ LN
P? LET W/ NEXT
```

Graphics line note:
1: 1, S

Then type in:
POKE 16517,71

If you want to save this program, do it now because you will not be able to BREAK and save it after RUNNING. Then type in:
RAND USR 16514
and observe the results.

Our thanks to:
Scott Laska
2205 Calumet Drive
New Holstein, WI 53061

8K ROM

Type in the listing below. The REM statement must be entered exactly as shown.

Line notes:
1: TAN on the E key
50: inverse space (22)
80: A (12)

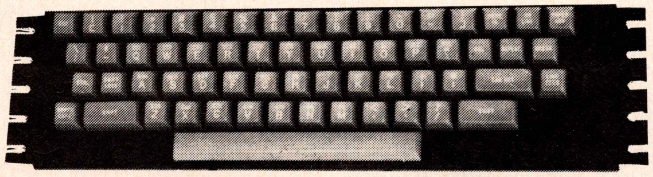
After the program has been entered, hit SLOW and ENTER and then RUN and ENTER. Observe the results. To exit the program hold the M key down and hit the BREAK key. You can exit the program by just hitting the BREAK key, but the screen display will "fall apart."

Our thanks to:
Tom Jury
415 W. Walnut St.
Lancaster, PA 17603

```
 10 REM Y000TAN
 20 POKE 16516,237
 30 POKE 16517,71
 40 FOR Y=5 TO 17
 50 PRINT AT Y,5;"■■■
```

A FEW WORDS about our KEYBOARDS

We only sell kits because we feel that the best way to add a quality keyboard to your computer, is to remove the bottom and solder 16 wires to the circuit board. If you can brush your teeth unattended then you possess all the manual dexterity needed to do the job. Most keyboards on the market are similar and will also require a little soldering If you can solder one end of a wire, you can assemble a kit. So, we only sell kits.



This keyboard was originally made for T.I. It has 62 full-sized keys with gold contacts mounted to a metal plate 4" by 15.5". This is a quality keyboard and our manual willshow you how to make full use of all those keys.

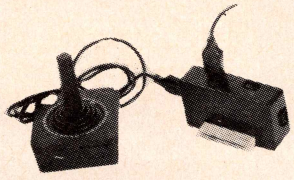
Keyboard with manual

$37.50

Our KEY-BOARD manual covers what you need to know about keyboards in general and shows how to wire them to your Sinclair or Timex computer. It includes circuits on how to use extra keys for Reset, Shift-lock, Auto-repeat, and other user-defined functions, plans for a 3 amp power supply that lets you run your computer and add-ons most anywhere, including your car, and plans for a case with tape and/or module storage. If you decide to buy a keyboard later, you may deduct the price of the manual.

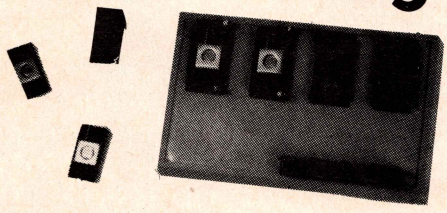
SYNCHRONIZE SYNCHRONIZE SYNCHRONIZE

EXPANDS EXPANDS EXPANDS



The Joystick Controller handles up to 4 Atari type joysticks. It allows full 8 direction movement and fire control in machine code for fast response.

Manual	$ 6.00
Bare-board; no manual	$12.00
Kit; board, parts, case, and manual	$39.95
Wired and tested	$49.95



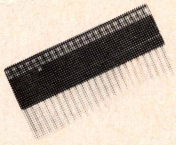
The EPROM Programmer puts an end to cassette tape headaches by letting you store programs in ROM. Simply load a program, then your computer can store it in one or more 2716 EPROM'S. The module holds four 2716's, giving you 8K of ROM in the 8K to 16K slot. By using ZIF (zero insertion force) sockets, ROM's can be changed as easily as cassettes. Programs load in seconds, not minutes; first time every-time. Store permanent machine code subroutines, upper/lower case character set, math symbols, special graphics, tool-kits, de-buggers, etc. all without using RAM.

Semi-kit; board, parts except EPROMs, plain sockets, manual, No case.	$49.85
Full-kit; Includes ZIF sockets and case Without EPROMs	$74.45
With EPROMs	$94.45
Wired and tested; Includes ZIF sockets Without EPROMs	$86.95
With EPROMs	$106.95
Bare-board; No manual	$19.75
Manual;	$6.00

EDGE CONNECTORS

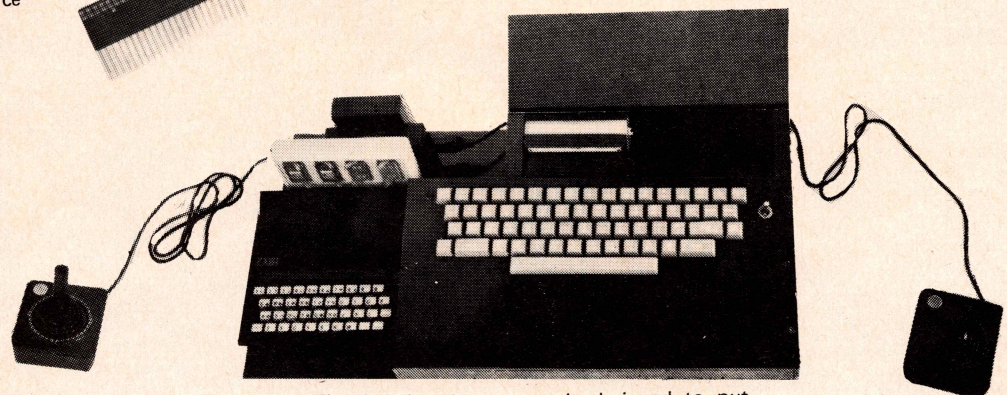
46 Gold contacts
Wire-wrap, solder tail, or PCB
Your choice

$4.95



VOLTAGE REGULATOR

LM323K
5 Volt
3 Amp
$3.95

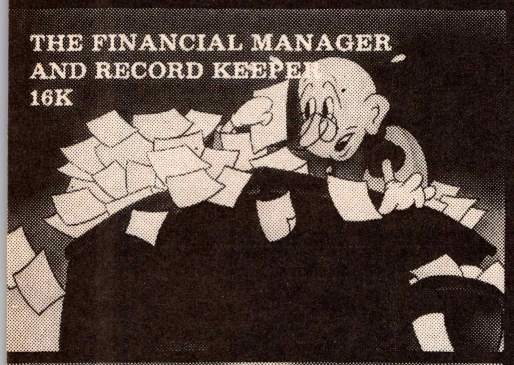


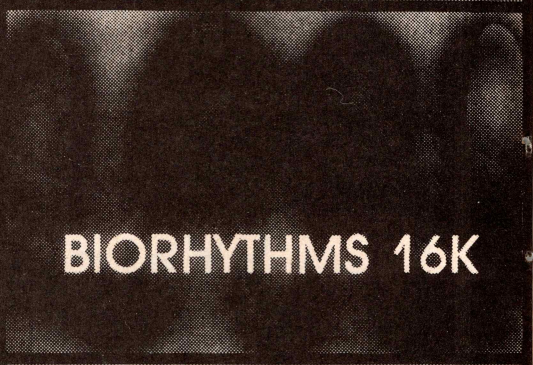
All prices postpaid U.S.A. only. In Canada add $2.00 for manuals or $5.00 for all other articals. All other countries add $4.00 for manuals or $10.00 for all other articals. U.S.A. funds only. Check,money order,VISA, Mastercharge. Phone orders accepted. Texas residents add 5% state sales tax.

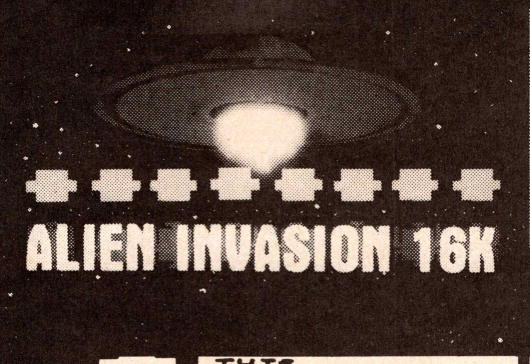
The Synchronize system is designed to put maximum fun and utility in your hands at minimum cost. Manuals for our products may be purchased separatly, and are complete enough to build your own modules using your own parts. If you decide to buy a kit or wired module, the price of the manual may be deducted from the advertised price.

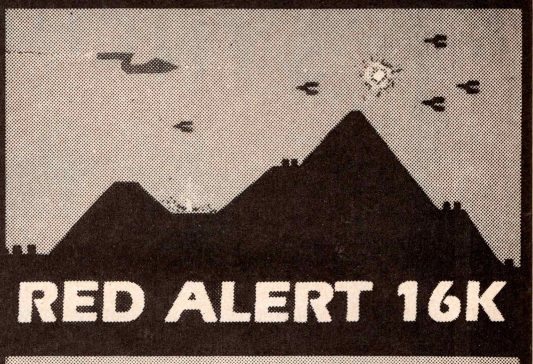
SYNCHRONIZE
SYNCHRONIZE
SYNCHRONIZE

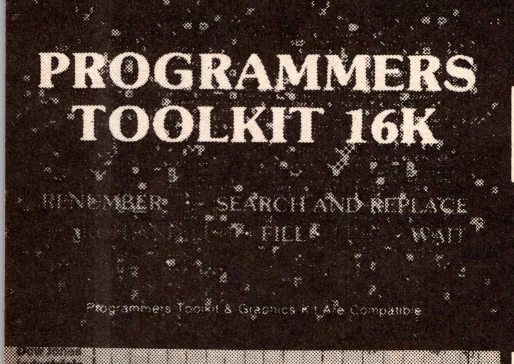
P.O. Box 1667
Kerrville, Tx. 78028
1-512-896-1288

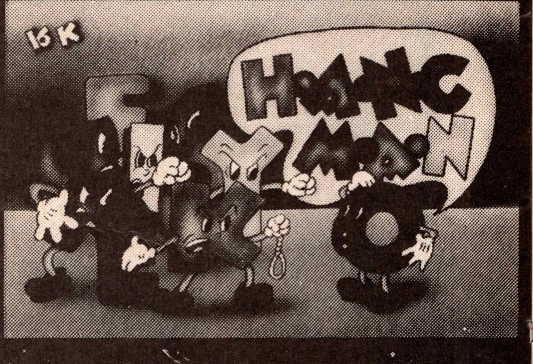


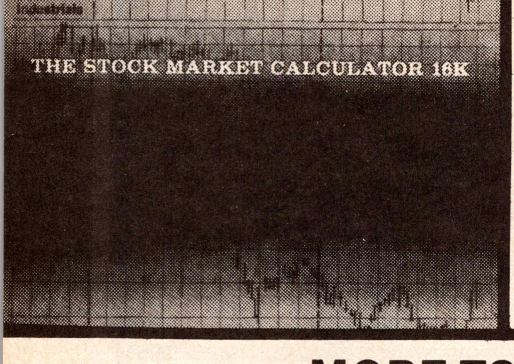


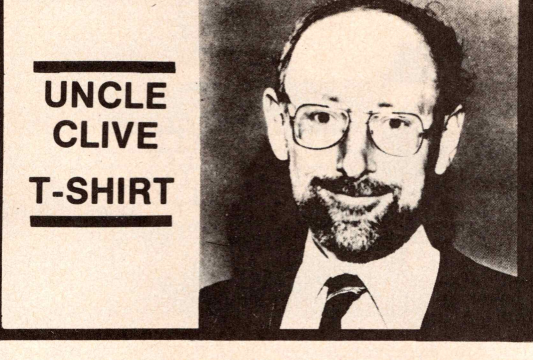


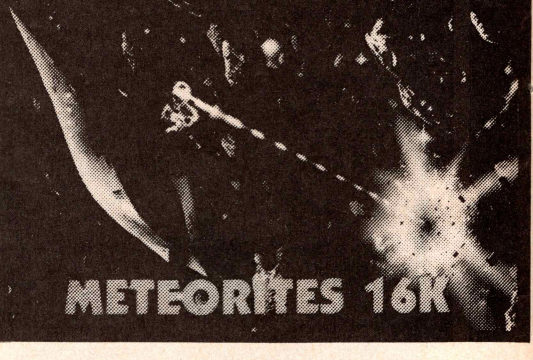












MORE TS1000/ZX81 SOFTWARE FROM...

SOFTSYNC, INC.

14 east 34 st N.Y. N.Y. 10016 — M/C & VISA ACCEPTED — (212) 685-2080

WRITE FOR FREE CATALOG & PROGRAM LISTING

just for fun

Generally *SYNC* prefers articles in some depth to help you get more out of your computer. However, we receive many short programs that illustrate a point, demonstrate a technique, or show something the reader has found interesting. "Just for Fun" shares these programs with you. If you learn something, great. If you have some fun, great. If you have some that you want to share, send them to: Just for Fun, SYNC, 39 E. Hanover Ave., Morris Plains, NJ 07950.

Mousetrap

M. Hampson

In "Mousetrap" your objective is to trap the mouse which is represented by the O. Your position is shown by the $. By constantly decreasing the amount of space the mouse has to run in, you will finally trap it in a small enough space and win the game. You decrease the space by building walls with the arrow keys. While you can go off the sides, you cannot go off the top or bottom. Your score will be displayed in the upper right hand corner. The aim is to get the lowest score possible.

Graphics line notes:

1 and 5: A (32).

8010: Inverse space (3), "GOT HIM. YOUR SCORE IS" in inverse characters, inverse space (2).

```
   1 PRINT "
   2 FOR Z=1 TO 20
   3 PRINT CHR$ 8;TAB 31;CHR$ 8
   4 NEXT Z
   5 PRINT "
   6 LET V=1+PEEK 16396+256*PEEK
 16397
   7 LET P=V+34+INT (RND*30)+33*
INT (RND*20)
   8 LET D=(32+(RND>.5)*2)*SGN (
RND-.5)
   9 LET Q=V+48
  10 LET GO=0
  99 LET A=0
 100 LET A=A+1
 101 IF A=9 THEN GOTO 8000
 102 IF PEEK (P+D) THEN GOTO 900
0
 105 POKE P,0
 110 LET P=P+D
 120 POKE P,52
 200 IF PEEK Q<>118 THEN POKE Q,
8
 210 IF INKEY$="8" THEN LET Q=Q+
1
 211 IF INKEY$="5" THEN LET Q=Q-
1
 212 IF INKEY$="6" THEN LET Q=Q+
33
 213 IF INKEY$="7" THEN LET Q=Q-
33
 220 IF PEEK Q<>118 THEN POKE Q,
13
 225 LET GO=GO+1
 230 GOTO 99
8010 PRINT AT 0,0;"
PUR SCORE IS ";
8020 PRINT 500-GO;"
8030 PAUSE 50000
8031 IF INKEY$="K" THEN GOTO 6
8035 CLS
8040 RUN
9000 GOTO 9500+D*10
9160 IF PEEK (P-33)=PEEK (P-1) T
HEN LET D=34
9161 IF PEEK (P-33) AND D=-34 TH
EN LET D=32
9162 IF PEEK (P-1) AND D=-34 THE
N LET D=-32
9163 GOTO 100
9180 IF PEEK (P-33)=PEEK (P+1) T
HEN LET D=32
9181 IF PEEK (P-33) AND D=-32 TH
EN LET D=34
9182 IF PEEK (P+1) AND D=-32 THE
N LET D=-34
9183 GOTO 100
9820 IF PEEK (P+33)=PEEK (P-1) T
HEN LET D=-32
9821 IF PEEK (P+33) AND D=32 THE
N LET D=-34
9822 IF PEEK (P-1) AND D=32 THEN
 LET D=34
9736 GOTO 100
9840 IF PEEK (P+33)=PEEK (P+1) T
HEN LET D=-34
9841 IF PEEK (P+33) AND D=34 THE
N LET D=-32
9842 IF PEEK (P+1) AND D=34 THEN
 LET D=32
9843 GOTO 100
```

M. Hampson, 7 Hereford Dr., Clitheroe, Lancs BB7 1JP, U.K. Reprinted from *The Ultimate Magazine* with permission.

Unvader

M. Hampson

You have all played various kinds of invader in which the ships are streaking in from above your base and you must defend yourself. Usually you are greatly outnumbered by a fleet of ships.

Have you ever wanted to be on the other side? Now you have that opportunity. "Unvader" lets you play the game from the other side. You are the attacker coming in from the top of the screen, and the ZX81 is trying to shoot you down.

Your mission is to land your ship safely on the hostile planet's surface. To do this you must dodge the shots aimed at you as you descend. Use the 5 key and the 8 key to move left or right and the 6 key to descend.

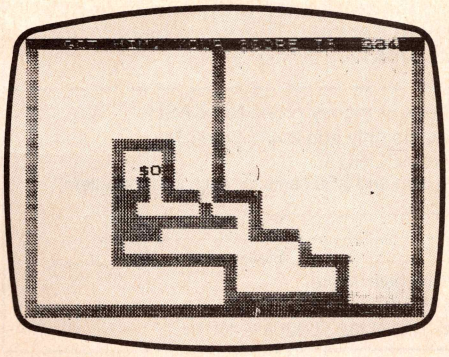
This program sets up the graphics for your ship, the ZX81's firing base, and the missiles can be seen. A hit on your ship is shown graphically.

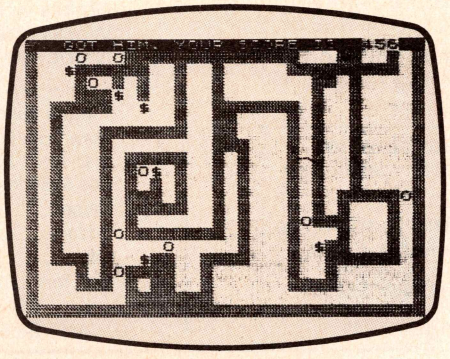
Graphics line notes:

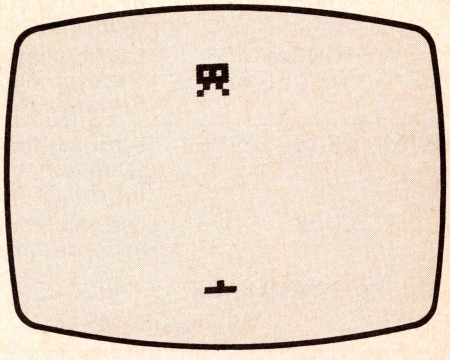
150: E, E, 5, R, R, 1, 6, W, 4.

210: 5

```
  10 LET P=15
  20 LET Q=1
  30 LET R=P
  40 LET C=0
  50 LET B=C
 110 LET R=R+SGN (P-R)*(RND>.5)
 120 LET P=P+(INKEY$="8")*(P<>29
)-(INKEY$="5")*(P<>0)
 130 LET Q=Q+(INKEY$="6")
 140 CLS
 150 PRINT AT 0,P;"
 ";TAB P;"
 ";TAB P;"
 ";AT 21,R;"
 "
 160 IF Q=19 THEN GOTO 300
 170 PRINT AT C,B;" "
 180 LET C=C-1
 181 IF C>0 THEN GOTO 190
 182 LET B=R+1
 183 LET C=20
 190 PRINT AT C,B;
 200 LET K=PEEK (PEEK 16398+256*
PEEK 16399)
 201 IF K<>0 AND K<>118 THEN GOT
O 400
 210 PRINT "
"
 220 GOTO 100
 300 PRINT AT 10,10;"**SUCCESS**
"
 301 STOP
 400 PRINT AT Q+2,P-2;"*BOOM*"
```







Draw and Store

James John Hollandsworth

Draw and Store not only allows you to draw a picture, but also to store your picture on tape for later use. When you have entered the program(or LOADed it), type in GOTO 1 and ENTER. The computer will ask if you want to draw the picture it has stored to be put on the screen or to erase and start a new picture.

The direction keys are used to move the pixel around. Holding the shift key down while pressing the keys leaves a trail.

When you want ot save a picture, hit ENTER and the display file will be PEEKed and put into a character array. SAVE the program and its array on tape. When you LOAD the tape later, you can also easily substitute your favorite drawing routine for the drawing routine section of the program.

James John Hollandsworth, Box 163, Montcoal, WV 25135.

Program notes:

1-80: The drawing routine.

505-550: Loads the array with the contents of the display file.

600-750: Reconstructs the picture from the character array.

2K RAM

```
  1 REM JJH 1-31-82
  2 REM USE GOTO 1
  5 GOTO 600
 10 LET Y=0
 15 LET X=0
 20 PLOT X,Y
 25 PAUSE 40000
 30 POKE 16437,255
 35 LET A=CODE INKEY$
 40 IF A=118 THEN GOTO 500
 55 IF A<100 THEN UNPLOT X,Y
 60 LET X=X+1*(A=36 OR A=115)*(
X<63)-1*(A=33 OR A=114)*(X>0)
 70 LET Y=Y+1*(A=35 OR A=112)*(
Y<43)-1*(A=34 OR A=113)*(Y>0)
 80 GOTO 20
505 FOR A=1 TO 22
510 FOR B=1 TO 32
520 LET A$(A,B)=CHR$ PEEK ((PEE
K 16396)+256*(PEEK 16397)+33*(A-
1)+B)
530 NEXT B
540 NEXT A
550 STOP
600 PRINT "8K ROM DRAW A PICTUR
E"
610 PRINT "NEW PICTURE? Y OR N"
620 INPUT D$
630 CLS
640 IF D$="N" THEN GOTO 700
650 DIM A$(22,32)
660 GOTO 10
700 FOR A=1 TO 22
710 FOR B=1 TO 32
720 PRINT A$(A,B);
730 NEXT B
740 NEXT A
750 GOTO 10
```

1K RAM

```
  1 PLOT X,Y
  2 PAUSE 40000
  3 LET A=CODE INKEY$
  4 IF A<100 THEN UNPLOT X,Y
  5 LET X=X+1*(A=36 OR A=115)*(
X<47)-1*(A=33 OR A=114)*(X>0)
  6 LET Y=Y+1*(A=35 OR A=112)*(
Y<37)-1*(A=34 OR A=113)*(Y>0)
  7 GOTO 1
```

Number Nine

Jon Passler

The object of Number Nine is to overwrite the digits 0 to 9 in order without recrossing your path or exceeding the boundaries of the playing area.

Enter line 1. Note that keywords are used to save memory. Do not type them in letter by letter. First enter 1 PAUSE, backspace, enter UNPLOT, and backspace agains, and enter REM. Proceed to enter the rest of the characters shown in the line.

Graphic line notes:

1: T, A, and 3.

21: graphics space.

31: A.

After entering the program, enter in the immediate mode, i.e., without a line number:

LET R=16514

LET B=156

LET C=165

LET S=15

LET O=2

LET K=1+PEEK 16396+256*PEEK 16397

K will have to be reinitialized if any changes are made in the length of the

Jon Passler, 344 Cabot St., Beverly, MA 01915.

ZX81 CLEVA computer ware TS1000

ENTERTAINMENT PROGRAMS

ORDER #		
CK161	SNAKEBITE	Eat the snake before it eats you. Variable speed. Create your own hazards.
	BATTLE	Demanding game of military strategy that can be played by 1 to 4 players.
CK162	STARSHIP TROJAN	Pit your wits against the dangers of outer-space and try to save your damaged space-craft.
	PRINCESS OF KRAAL	Face the monsters hiding in the underground complex to find the treasure and save the Princess.
CK163	STARTRACK	Use graphic photon torpedo attacks to kill off the highly mobile Klingons.
	FUNGALOIDS	Save civilization by bombing the ever-multiplying fungus. Beware—it fights back.
CK164	CRAZY-CARDS	Learning the rules does not seem to help. Totally addictive for cheats.
	CUBE	Use your computer to solve the mysteries of the Rubik Cube.

TWO GAMES FOR THE PRICE OF ONE (ONLY $9.95)

All PROGRAMS 16K

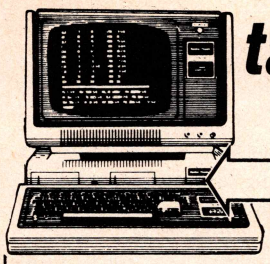
MACHINE LANGUAGE PROGRAMS

CK165 ASSEMBLER $9.95
2 pass assembler written especially for the ZX81/TS1000 (16K). It is simply the best assembler available for those who wish to write their own machine code programs. It is designed to run alone, or together with the dis-assembler, and/or the de-bugging program. These provide a system for writing, editing, checking and testing machine code programs that is second to none.

CK166 DIS-ASSEMBLER $9.95
Allows you to read the ZX81/TS1000 ROM (16K) with the best dis-assembler program available. It is written specifically for Sinclair/Timex computers, and unlike some programs modified from Intel 8080 dis-assemblers it gives full Z80 Mnemonics.

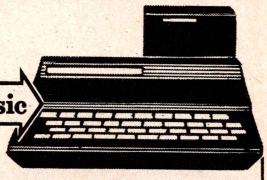
CK167 DE-BUGGER $9.95
Makes writing machine code programs easier. Works entirely in decimal. Therefore hexadecimal is not needed. (16K)

Please send check or money order. NO CASH!
New York Residents only add 8¼% Sales Tax.
SHIPPING AND HANDLING
Add $1.50 for first item and $.50 cents for each additional item.
Name_____
Address_____
City_____ State_____ Zip_____
Mail To: CLEVA Computer Ware
P.O. Box 2736
Brooklyn, N.Y. 11202 (212) 875-1207



take the HARD WORK *out of* SOFTWARE!

Level II Basic → **COOK TransCoder I** ← Timex/Sinclair Basic



FROM COOK LABS — #1 IN CASSETTE SOFTWARE DUPLICATION

- **Translate and/or edit T/S or ZX-81 the fast, easy way.**
- **Save 75% or more of valuable programming time.**
- **RAM-to-RAM dialogue shuttles back and forth at machine speed — faster than disc.**
- **Meet the huge oncoming T/S software market by:**
  1) **translating Level II libraries automatically;**
  2) **writing and editing in either Level II or Sinclair Basic on a conventional keyboard.**

The TransCoder I comprises a combination of software and hardware. The hardware holds an 11-chip board that plugs directly into the expansion port of a R/S Model I or Model III (32K min.). The several K bytes of machine software reside in R/S high memory.

The excellent editing facilities of the host R/S computer directly apply to editing of T/S Basic programs because the T/S Basic listing will appear on the screen of the R/S monitor.

Translation of Level II Basic program listings into T/S Basic is accomplished and displayed through software on command, with directly untranslatable statements flagged for the programmer's attention. Programs can then be shuttled to T/S for final debugging and to check displays on the T/S screen.

Communication between the Radio Shack and the Timex/Sinclair operates in either direction and is non-destructive of the sending source. When completed, programs in T/S Basic can be filed on R/S disc or tape for safety and convenient reference.

The complete TransCoder I package — hardware, software, manual — is priced at only $490,* and will be available in early October. Orders will be filled in sequence as received. Please write or phone if you need more information.

*Subject to change without notice.

COOK LABORATORIES, INC.
P.O. Box 529
Norwalk, CT 06856 (Phone 203-853-3641)

☐ Send TransCoder I to address given at right. I enclose check or M.O. for $500 which includes $10 for handling & shipping (Conn. residents please add sales tax).

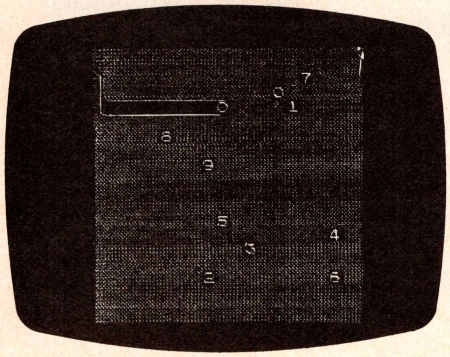
☐ Send information about COOK software duplication services.

NAME_____

COMPANY_____

ADDRESS_____

_____ZIP_____



```
   1 REM ▞=Y▓:=NOT $4 UNPLOT YV▗
NOT ( PAUSE TAN
   3 RAND USR R
   5 FOR A=B TO C
   7 PRINT AT RND*S+O,RND*S+O;CH
R$ A
   9 NEXT A
  11 LET X=NOT PI
  13 LET Y=X
  15 FOR A=B TO C
  17 PRINT AT X,Y;CHR$ A
  19 LET I$=INKEY$
  21 PRINT AT X,Y;"▓"
  23 IF I$<"I" OR I$>"M" THEN GO
TO S+O
  25 LET X=X+(I$="M")-(I$="I")
  27 LET Y=Y+(I$="K")-(I$="J")
  29 LET L=K+X*21+Y
  31 IF PEEK L=CODE "▓" THEN GOT
O S+O
  33 IF PEEK L=A THEN NEXT A
  35 IF A>C THEN POKE L,CODE "W"
```

program. Once the variables have been entered, (do not enter) CLEAR or RUN or they will be erased. Use GOTO 1 to "run" the program.

Use the I, J, K, and M keys to move the flashing black character at print position O,O. This is the character to use in overwriting the digits 0 to9, and it should alternate between being an inverse space and an inverse representation of the next digit to be overwritten. Before starting however, make sure all digits) to 9 are on the gray field and that none got overwritten by another. If you successfully overwrite 0 to 9 then you will be rewarded with a W to indicate a win. If you are not successful, the program will end with a 0/35 error message.

Eliminator

Sheldon Maloff

In Eliminator the object is to maneuver your spaceship to eliminate as many stars as possible by running over them.

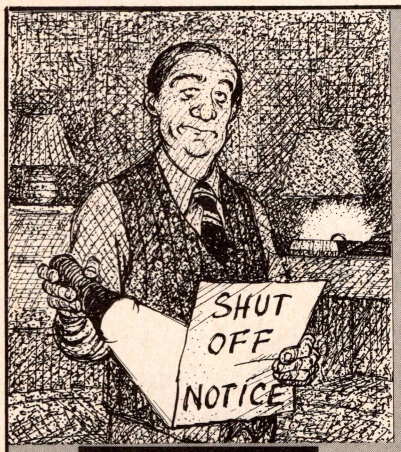
The stars are indicated on the screen by the asterisk. Your ship's view screen will display a constellation of eight stars. Your space ship is moved down by the A key and up the L key. You have 10 chances to cross the screen. On each passage you try to eliminate as many of the stars as possible. Upon each crossing, your score is updated to reflect how many stars you have eliminated and eight new stars appear.

Graphics notes:

2: inverse space

Sheldon Maloff, 102-432 Huntsville Cres., N.W., Calgary, Alberta, Canada T2K 5E1.

```
   1 FOR Z=SGN PI TO VAL "256"
   2 PRINT "▓";
   3 NEXT Z
   4 LET P=PEEK VAL "16396"+VAL
"256"*PEEK VAL "16397"
   5 LET S=NOT PI
   6 LET R=VAL "133"+P
   7 FOR T=SGN PI TO VAL "10"
   8 FOR Z=SGN PI TO VAL "8"
   9 LET X=RND*VAL "263"+SGN PI+
P
  10 IF PEEK X=VAL "118" THEN GO
TO VAL "9"
  11 POKE X,VAL "151"
  12 NEXT Z
  13 FOR Z=SGN PI TO VAL "31"
  14 IF PEEK (R+Z)=VAL "151" THE
N LET S=S+SGN PI
  15 POKE R+Z,VAL "146"
  16 POKE R+Z,VAL "128"
  17 IF INKEY$="A" THEN LET R=R+
VAL "33"
  18 IF R>=VAL "264"+P THEN LET
R=R-VAL "33"
  19 IF INKEY$="L" THEN LET R=R-
VAL "33"
  20 IF R<=P THEN LET R=R+VAL "3
3"
  21 NEXT Z
  22 PRINT AT SGN PI,SGN PI;S
  23 NEXT T
```

EVEN IF YOUR LIGHTS GO OUT YOUR COMPUTER WON'T

Introducing

NiCd Battery Back-Up Units from Syncware

- Make your ZX Portable BBU-2 runs over 2 hr. BBU-1 runs 1 hr. Baby BBU runs ½ hr.
- Make your ZX immune to line glitches!
- Protection against brown-outs, blown fuses, etc.

PRICES:
Baby BBU — 39.50
BBU-1 — 54.50
BBU-2 — 84.50

Now Available — TS1000's with built-in battery back-up and LED power indicators.

TS-1000-B30 – 30 min. backup $129.50
TS-1000-B60 – 60 min. backup $142.50

TIRED OF LINE GLITCHES GIVING YOUR COMPUTER AMNESIA?

Let Syncware take the annoyance out of computing. Baby BBU and BBU-1 use existing power supply; in case AC line goes dead or power supply gets knocked out of socket, battery takes over until power restored, preventing memory loss.

BBU-2 contains built-in heavy duty power supply, eliminating need for original supply. In addition, BBU-2's output is pre-regulated at 8 volts for additional glitch rejection, and also lets your ZX run considerably cooler. DON'T WAIT FOR A SUDDEN CRASH BEFORE YOU ORDER YOURS!

Prices are postpaid in continental U.S. Foreign orders — add $5.00. Payment must be in U.S. currency. Send check, money order or international M.O. only.

SYNCWARE co.
P.O. BOX 5177, EL MONTE, CA 91734

KAYDE Electronic Systems

ZX80/1
ZX KEYBOARD WITH REPEAT KEY

$75.90

Fully cased keyboard $75.90
Uncased keyboard..... $55.90
Keyboard Case..... $21.90

This is a highly professional keyboard using executive buttons as found on top quality computers. It has a repeat key and comes complete in its own luxury case. This is a genuine professional keyboard and should not be confused with toy keyboards currently available on the market.

KAYDE 16K RAM PACKS

$59.90

The 16K RAMPACK simply plugs straight into the user port at the rear of your computer. It is fully compatible with all accessories and needs no extra power and therefore it will run quite happily on your Sinclair power supply. It does not over-heat and will not lose memory at all. As you may know, some makes go down to 11K after being on for a while.

This 16K RAMPACK is very stable and will not wobble or cause you to lose your programme. It comes fully built and tested with a complete money-back Guarantee.

KAYDE FLEXIBLE RIBBON CONNECTOR

$25.90

Stops movement of RAM PACK and other accessories
(Not needed with a *KAYDE* RAMPACK)

KAYDE 4K GRAPHICS BOARD

$59.90

The *KAYDE* Graphics Board is probably our best accessory yet. It fits neatly inside your ZX81. It comes complete with a pre-programmed 2K Graphics ROM. This will give nearly 450 extra graphics and with the inverse makes a total of over nine hundred.

The *KAYDE* Graphics Board has facilities for either 2K of RAM (for user definable graphics), 4K of ROM or our 4K Tool Kit Chips that will be available shortly. All the graphics are completely software controlled, therefore they can be written into your programmes. Here are a few examples: **A full set of space invaders — Puckman — Bullets, Bombs — Tanks — Laser Bases and Alien Ships.**

NO EXTRA POWER NEEDED

KAYDE 16K GRAPHICS BOARD SOFTWARE

$11.90

PECKMAN: The only true ZX version of the popular arcade game.
Centipede: "In all I think this is the best presented moving graphics program I've yet seen." Phil Garratt, Interface.
SPACE INVADERS: The best version available anywhere. Graphics software can only be used with a graphics board.

KAYDE 16K 81 SOFTWARE

$11.90

Centipede: "In all I think this is the best presented moving graphics program I've yet seen." Phil Garratt, Interface.
3D/3D Labyrinth: A Cubit Maze that has corridors which may go left, right, up, down. Peckman (the latest addition in 81 games).

WHY WAIT TO PAY MORE —
FAST, IMMEDIATE DELIVERY

Post to: Dept **SY-3**
Kayde Electronic Systems Ltd
The Conge
Great Yarmouth
Norfolk NR30 1PJ ENGLAND
Tel: 0493 57867 (Dept. SY1)

Please pay by
International money order or certified
cheque for immediate delivery.

Please send me .....ZX Keyboards with repeat key $75.90 each
Please send me ..... 16K RAMPACKS $59.90 each
Please send me .....Flexible ribbon connectors $25.90 each
Please send me ..... 4K graphics boards $59.90 each
Please send me ..... 16K graphics board software $11.90 each
Please send me ..... 16K 81 software $11.90 each

I enclose _____

Name _____

Address _____

_____

_____

Please add $5 p&p for all hardware and $2 for all software. Please make cheques payable to Kayde Electronic Systems Ltd.

CONVERT YOUR ZX..

FULLER MICRO SYSTEMS ADD STYLE, POWER, VERSATILITY AND FULL TYPEWRITER KEYBOARD OPERATION TO THE AMAZING ZX81 COMPUTER!

THE FULLER FD42 SYSTEM

The ideal Christmas Gift for ZX81 users.

If you already are the proud owner of the fastest selling small computer in the U.S., or maybe have a friend or member of the family who's a ZX fanatic, what better buy is there this Christmas than the famous Fuller FD42 System! It converts your ZX81 into a sturdy, attractive and professional unit, with full sized typewriter keyboard. All the Sinclair ZX81 keys are duplicated with extra shift and new line keys. The professional momentary action key switches have a guaranteed life of 10^8 operations, and the whole unit comes to you complete with a money back guarantee.

IT'S EVEN CHEAPER IN KIT FORM!

FD 42 keyboard and case kit.

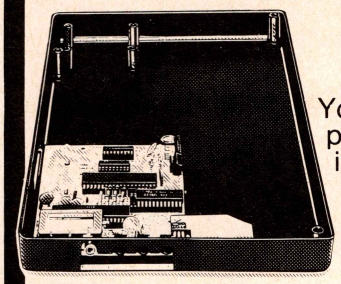
$67.95 *+ $6 p & p.*

FD 42 keyboard kit

$37.95 *+ $4 p & p.*

Turn your ZX81 from this to this for . . .

NOW ONLY $79.95 + $6 p & p.



IT'S SO EASY TO INSTALL!

You simply unscrew the ZX printed circuit board from its base, screw it into the the new FD case, and plug in the keyboard. No soldering or technical knowledge required.

FULLER MEMORY EXPANSION

a massive boost for your ZX81!

The basic ZX81 has only 1k of RAM – now you can add on an enormous 16 or 64k with our FD Memory Modules.

FD16k _____ ***$49.95*** *+ $4 p & p.*

FD16k to fit inside Fuller case _____ ***$59.95*** *+ $4 p & p.*

FD64k Memory Module _____ ***$129.95*** *+ $4 p & p*

ZX81 MOTHERBOARD

Also easy to install! The FD system Motherboard fits inside the Fuller case and allows expansion to the ZX memory and 1/0 facilities

_____ 2 slot ***$30.95*** *+ $4 p & p.*

_____ 3 slot ***$39.95*** *+ $4 p & p.*

NEW! – Programmable Sound Generator

– adds exciting new sounds to the ZX81 range ***$39.95*** *+ $4 p & p.*

Separate P.S.U. 9 volts @ 2 amps ***$14.95*** *+ $4 p & p.*

Plug Planner – complete with 3 metres of cable and power jack ***$36.95*** *+ $6 p & p.*

Ram Adaptor Board – adapts Sinclair RAM pack to fit inside Fuller case ***$19.95*** *+ $4 p & p.*

Please supply the following items:

ITEM	PRICE†	Qty.	TOTAL
Fuller FD System 42 Keyboard & case			
Fuller FD System 42 (Kit form)			
Fuller FD System Motherboard			
Fuller FD 16K. Memory Module			
Fuller 64K. Memory Module			
Sound Generator			
FD PSU 9 Volts at 2 amp.			
Fuller FD Shipping and Handling			
AD CODE			

Mail to **FULLER MICRO SYSTEMS,**
The ZX Centre, Sweeting Street, Liverpool 2.
England U.K.

Name .....

Address .....

City /State/Zip .....

† US Dollars

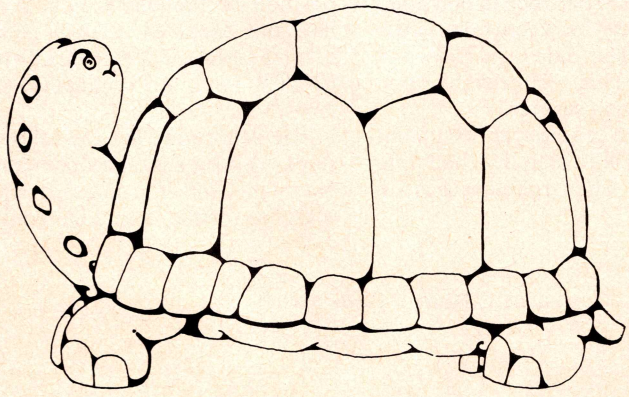
SY.12.82

Fuller MICRO SYSTEMS

Mail to: **FULL MICRO SYSTEMS,**
The ZX Centre, Sweeting Street, Liverpool 2.
England U.K. Telephone: 051-236 6109

Turtle Graphics

Morgan Woodson



Introduction

Have you ever wished for an easier way to create graphics displays on your Sinclair computer? You can always use a line drawing program and a table of coordinates, but setting up the table can be tedious. The LOGO language, developed by the artificial intelligence group at MIT, has a graphics system called Turtle Graphics which might make your wish come true.

Turtle Graphics is named for the "turtle" robot originally used to draw the figures. It was equipped with a pen in addition to motors to move it. When graphics displays became economically and technically feasible, they were used. Since this system offers some interesting graphics possibilities, I decided to see how it might be done on the Sinclair computers.

Let us begin by imagining our turtle and assign four attributes to it: an x position, a y position, an angle (in degrees), and a pen up or down (see Table 1). We will guide our turtle by using five commands. FORWARD n moves the turtle n spaces forward in the direction of the angle it is pointing. RIGHT n and LEFT n change the direction that the turtle is facing n degrees, but do not move it. UP and DOWN move the "pen" into a draw or no-draw condition.

Implementing Turtle Graphics

The first problem in implementing Turtle Graphics on a Timex/Sinclair computer is determining the new x and y coordinates after a FORWARD n command. The RIGHT n and LEFT n commands are easy. All that we have to do is add or subtract the n values from the turtle angle. The UP and DOWN commands are even easier because executing them consists of changing a flag.

Morgan Woodson, 39 Winter St., Wakefield, RI 02879.

To figure out how to move the turtle, I drew a right triangle with the distance to travel forward as the hypotenuse (see Figure 1). This requires some simple trigonometry (see Figure 2). The new x coordinate was the old one plus the cosine of the turtle angle times the distance to travel. The y coordinate uses the same formula except that the sine of the turtle angle is used.

The next step was to write the program. I put it in the form of a subroutine to make it more convenient to use. The commands are stored in a string variable (A$) before calling the turtle routine. The graphics commands are reduced to single letters to simplify the string splitting part of the subroutine (see Table 2).

Connecting the new point to the old was initially done by means of a line drawing subroutine from the ZX81 manual. Since the ZX81 uses radians instead of degrees, the degrees have to be changed to radians. At first I made the change when the RIGHT and LEFT commands were executed; however, to save memory, I changed to program so that the turtle angle was in degrees and not changed to radians until the FORWARD command was executed.

Table 1. List of Variables and Functions.

Variable	Function
A$	Turtle Graphics commands and arguments.
B$	Current command
X	Turtle x coordinate
Y	Turtle y coordinate
A	Turtle angle in degrees
P	Turtle pen condition
I	Loop variable and position of next command in A$
D	Argument for Turtle command
R	Turtle angle in radians
J	Another loop variable
C	Cosine of Turtle angle
S	Sine of Turtle angle.

Table 2. List of Commands and Functions.

Command	Abbreviation	Function
FORWARD n	Fn	Moves Turtle forward n spaces
RIGHT n	Rn	Turns Turtle right n degrees
LEFT n	Ln	Turns Turtle left n degrees
UP n	Un	Makes Turtle not draw (argument has no effect)
DOWN n	Dn	Makes Turtle draw (argument has no effect)

Then when the program worked, I removed the line drawing routine. Instead of moving the whole distance in one jump and drawing a line between points, the program moves one unit at a time and plots each point. This produces the same effect, but it is much shorter.

The last change requires an argument for UP and DOWN to simplify the string splitting routine. The argument has no effect.

The driver routine (see Listing 1) sets up the initial position, heading, and pen position of the turtle, gets a command line and executes it, then gets another command line. To exit this routine, type ENTER (with no command) to get an error.

The subroutine has the following main steps: 1) it puts the first command of the command line into another string; 2) it searches for the next command and puts the argument into the variable "D"; 3) it executes the command by going to the FORWARD routine (line 600) or changing a variable; 4) the command and argument just executed are deleted and, if there is more on the line, it is executed.

The FORWARD routine first converts the turtle angle from degrees to radians. Next the cosine and sine of the angle are calculated. Originally, they were in the loop that draws the path of the turtle. Putting them before the loop greatly reduced computing time. The loop finds the new x and y coordinates and plots them if the "pen" is down. Lastly, the routine jumps to the part of the turtle subroutine that decides whether to RETURN or continue executing turtle commands.

Figure 1. Turtle Triangle.

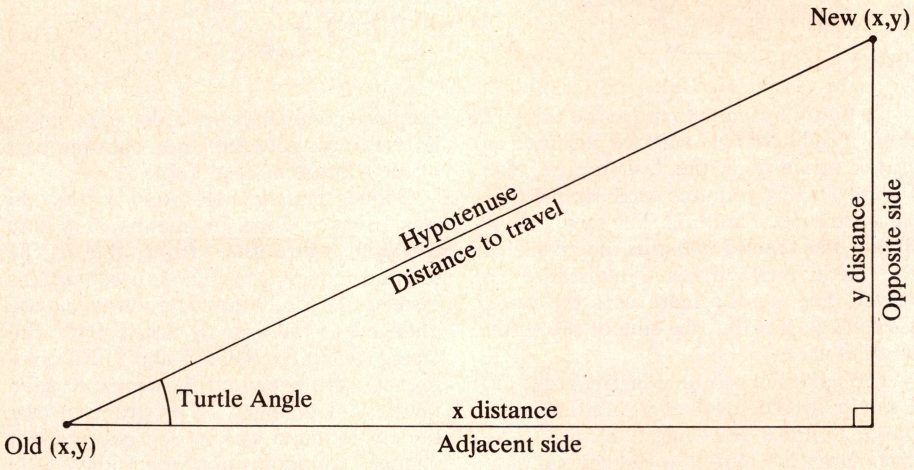


Figure 2. Computations.

DY	Vertical distance to travel (unknown)
DX	Horizontal distance to travel (unknown)
D	Distance to travel (known)
A	Turtle angle (known)
X	Turtle X coordinate (known)
Y	Turtle Y coordinate (known)
New X	Turtle X coordinate after movement (unknown)
New Y	Turtle Y coordinate after movement (unknown)

To find the horizontal distance:

$$\text{Cos A} = \frac{\text{Adjacent}}{\text{Hypotenuse}}$$

$$\text{Cos A} = \frac{\text{DX}}{\text{D}}$$

$$\text{Cos A*D} = \text{DX}$$

To find the vertical distance:

$$\text{Sin A} = \frac{\text{Opposite}}{\text{Hypotenuse}}$$

$$\text{Sin A} = \frac{\text{DY}}{\text{D}}$$

$$\text{Sin A*D} = \text{DY}$$

To find the new x and y coordinates:

New X=X DX
New X=X Cos A*D
New Y=Y DY
New Y=Y Sin A*D

Using the Program

To use the program, type both parts in. Then hit RUN and ENTER. The screen will be blank except for a cursor waiting for a string. Type "F10" and ENTER. The screen will go blank and then reappear with a line from the center of the screen toward the right edge of the screen. This is because the turtle was facing to the right and you instructed it to move forward 10 spaces in that direction. Now type "R90 F10". This time another line will appear, perpendicular to the first line. The turtle has made a right turn and has gone forward again. Now type "R90 F10 R90 F10". A square will now appear on the screen. This repetition of turning and moving can produce all kinds of polygons easily. Going right 144 degrees and forward 10 spaces five times will produce a five point star.

You can continue to play around with turtle graphics using the driver program supplied, or you can use the subroutine in your programs to produce more complex figures. ■

Listing 1. Turtle Graphics Driver.

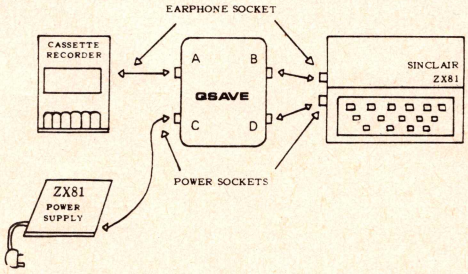
```
  1 REM TURTLE GRAPHICS DRIVER
  2 LET P=1
  5 LET A=0
 10 LET X=32
 20 LET Y=22
 30 INPUT A$
 40 GOSUB 500
 50 GOTO 30
```

Listing 2. Turtle Graphics Subroutine.

```
 500 REM TURTLE GRAPHICS SUBROUT
INE
 510 LET B$=A$(1)
 530 FOR I=2 TO LEN A$
 540 IF A$(I)=" " THEN GOTO 560
 550 NEXT I
 560 LET D=VAL A$(2 TO I-1)
 565 IF B$="F" THEN GOTO 600
 567 IF B$="U" THEN LET P=0
 570 IF B$="R" THEN LET A=A-D
 575 IF B$="D" THEN LET P=1
 580 IF B$="L" THEN LET A=A+D
 585 LET A$=A$(I+1 TO )
 590 IF A$="" THEN RETURN
 595 GOTO 500
 600 LET R=A/57.296
 602 LET C=COS R
 605 LET S=SIN R
 610 FOR J=1 TO D
 620 LET X=X+C
 630 LET Y=Y+S
 640 IF P THEN PLOT X,Y
 650 NEXT J
 660 GOTO 585
```

QSAVE
THE FAST ONE

All ZX81 owners can now load/save a full 16K in only 29 seconds with the incredible QSAVE hardware/software combination package from PSS.



Just look at these features:

1. No hardware modifications are needed
2. No extra power supply is needed
3. QSAVE is compatible with your existing tape recorder
4. QSAVE includes a verify feature to ensure successful saving
5. No more wasted time waiting for programs to load or save

MOST IMPORTANT OF ALL—QSAVE IS EASY TO USE—SIMPLY PLUG THE QSAVE AMPLIFIER/FILTER UNIT BETWEEN YOUR RECORDER AND THE ZX81 (all leads are supplied) — THEN LOAD THE QSAVE SOFTWARE BEFORE YOU LOAD A TAPE OR KEY IN A PROGRAM. YOU CAN NOW SAVE AND RELOAD A FULL 16K IN ONLY 29 SECONDS — ie. A DATA TRANSFER RATE OF 4000+ BAUD COMPARED WITH ONLY 250 o ON THE STANDARD ZX81.

16K/64K VERSION — Please state version when ordering

REVOLUTIONIZE YOUR PROGRAMMING NOW FOR THE ALL INCLUSIVE PRICE OF ONLY $37.50.

M CODER

EVER WANTED TO WRITE MACHINE CODE PROGRAMS? NOW YOU CAN

THE FIRST REAL MACHINE CODE COMPILER FOR THE ZX81

SIMPLY WRITE YOUR PROGRAM IN BASIC (OR LOAD AN EXISTING PROGRAM), PRESS A KEY AND M CODER WILL AUTOMATICALLY COMPILE IT INTO MACHINE CODE.

M CODER HANDLES 99.9% OF ALL BASIC

ONCE USED YOU'LL NEVER WRITE BASIC PROGRAMS AGAIN

GIVE ALL YOUR PROGRAMS THAT SUPER-FAST PROFESSIONAL LOOK WITH M CODER

BUY M CODER NOW AND REVOLUTIONIZE YOUR PROGRAMMING FOR THE ALL INCLUSIVE PRICE OF ONLY £7.95

Ever wanted to write machine code programs? Now you can. The *First* real machine code compiler for the ZX81

Send check or money order to:

PSS Personal Software Services
482 Stoney Stanton Rd.
Coventry CV6 5FE U.K.
Telephone Coventry (0203) 667556

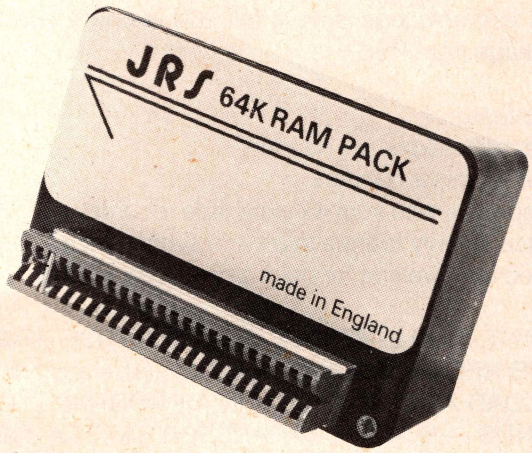
Name _____

Address _____

City/State _____ Zip _____

Now available in the U.S. at the incredible price of only $119.95 (£62.95)

ACTUAL SIZE 3" × 2"



THE 64K RAM PACK

- Fully built, tested and guaranteed.
- No additional power supply required.
- Black plastic case no larger than 16K RAM PACK.
- No wobble problems
- Fully compatible with printer etc.

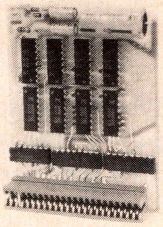
The use of this memory is as follows:-

0 – 8K	Sinclair ROM
8 – 16K	RAM that is unaffected by NEW, LOAD, SAVE and can be used for storing machine code routines.
16 – 32K	BASIC Code, Display file, Variables, Machine Code
32 – 64K	Variables

ALSO AVAILABLE

16K RAM PACK at only $49.95 (£29.95)
including *FREE ALIEN ATTACK (7K -M/code)* — value $11.00 (£5.75)
As reviewed in 'Your Computer' – (March 1982) the leading U.K. Sinclair Publication. Almost 10.000 units sold in the U.K. so far.

THE 'NO FRILLS' ECONO TECH 16K RAM PACK ONLY $39.95 (£20.95)
We believe the Econo Tech is the lowest priced 16K RAM available anywhere.
No frills - just a reliable and economical way to expand your ZX81.
As reviewed in 'ZX Computing' August/Sept 1982, the new U.K. ZX computer publication. Available ONLY from JRS.



PLEASE NOTE: All prices are fully inclusive and are applicable for export, including airmail postage. Payment may be made in sterling (Money Order available at your bank) or your own U.S. $ cheque, made payable to JRS SOFTWARE.
Despatch normally 7 days from receipt of order

JRS SOFTWARE

19 WAYSIDE AVENUE, WORTHING, SUSSEX, ENGLAND, BN 13 3JU Telephone: (0903) 65691

Curve-plotting Graphics

Richard Booth

Curve-plotting has many applications. For example, an oscilloscope is a curve-plotting device which allows the user to view time-varying voltages. This article presents a program which allows the Timex/Sinclair computers to be used as curve-plotting devices. The common representations of curves possible with this program include the following: Cartesian, Cartesian Parametric, polar, and polar parametric. An example of a polar plot would be the radiation pattern of an antenna. The program requires the 8K ROM and makes use of pixel graphics.

An Introduction to Curves

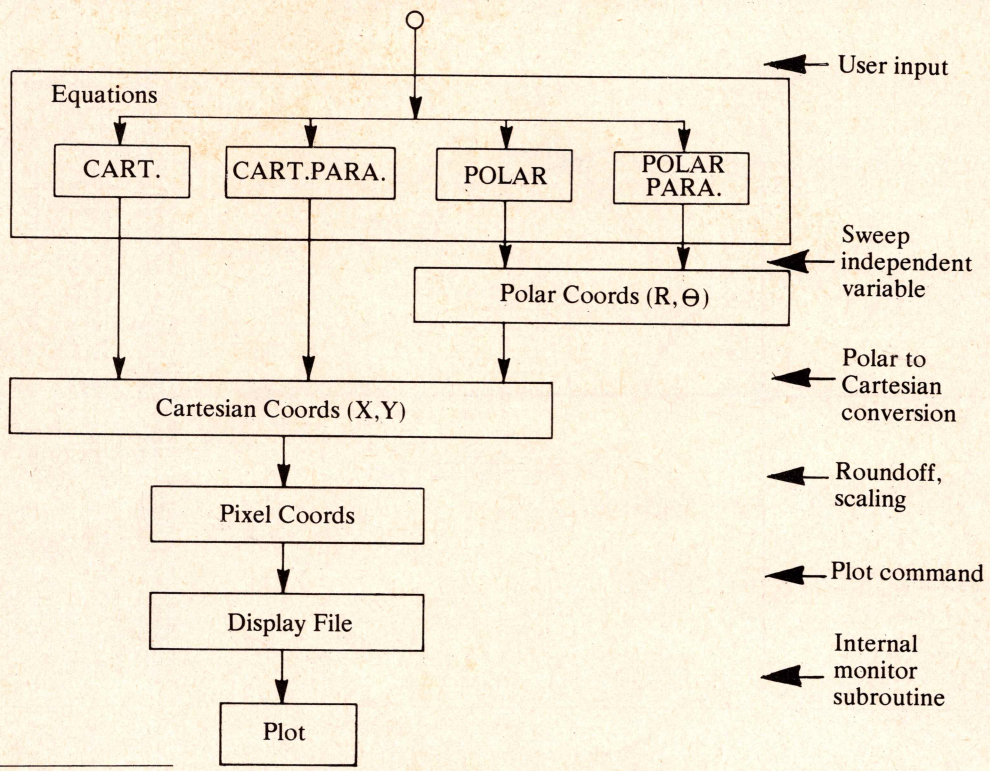
A plane curve is a two-dimensional path or set of points. Plane curves are found in such everyday places as the path followed by an ant on the kitchen floor or a magazine article on inflation. They can also be found in special places such as an oscilloscope trace or the spirals of a sunflower.

A plane curve can be described mathematically in various ways. A description which is adquate must be useful for the particular application at hand. For example, if the application is target shooting, it is only necessary to know whether a given trajectory passes through the bull's-eye. Since the application addressed in this article is curve-plotting using the ZX81, an adequate description would tell which pixels the curve passes through. This description will be used to construct a display file which in turn will be used to display the plot of the curve.

Many curves can be described most concisely by the use of one or more equations. The equations can then be used to generate points of the curve. The curve-plotting program in this article operates by creating levels of descriptions of the curve as shown in Figure 1.

A point is located with respect to some reference system. There are no requirements upon the position or scale of the reference system itself so a convenient location and scale may be chosen. A Cartesian reference system is an X-Y axis. A polar reference system is a ray. In the Cartesian reference system a point is described by the coordinates (X,Y) of X

Figure 1. Levels of curve descriptions generated by curve-plotting program.



Richard Booth, 12875 Highland Rd., Highland, MD 20777.

and Y intercepts. In a polar reference system, a point is described by the coordinates (R, Θ),where R is the length of the line segment between the base of the ray to the point and Θ (theta) is the angle between the line segment and the ray. Figure 2 shows the plot of a curve containing the point

$$(R_p\ \Theta_p)$$

The positive X-axis of a Cartesian reference system coincides with the polar reference system. In this Cartesian reference system the point is described by

$$(X_p, Y_p) = (R_p \cos\Theta_p, R_p \sin\Theta_p)$$

The curve-plotting program converts polar coordinates to Cartesian coordinates in this way to make use of the pixel graphics.

The methods used by the program to generate point coordinates make use of functional equations. A functional equation is one which evaluates some variable uniquely when the independent variable is given. This is expressed

$$V_D = f(V_I)$$

where V_D is the dependent variable and V_I is the independent variable.

The four approaches are best summarized in tabular form. See Figure 3.

To generate point coordiates, the independent variable is swept through a range of values and coordinates are calculated for values in the range.

Each type of description has its own advantages. For example, to generate a plot of a circle would take two sweeps of the independent variable using the Cartesian method, but only one sweep using the Cartesian parametric or polar methods.

Program Description

The program is listed in Figure 4. Lines 10-220 are used to input equations, plotting window, etc. Lines 220-350 generate the plot. Note that expressions are entered as string variables so that no program lines need to be changed for different plottings.

Also note in line 340 how points are scaled to pixel coordinates. Lines 300-330 remove points which are outside the plotting window.

Line 230 provides for 200 iterations of the FOR-NEXT loop. The number of iterations can, of course, be changed when necessary.

Program Use

The program first prompts the user with "CART., CART.PARA., POLAR, OR POLAR PARA.? (1,2,3, OR 4)". Enter the number corresponding to the plot you want. For example, for Cartesian plots, enter 1. Next, a plotting window is entered. This is the expected region which will be covered in Cartesian space. See Figure 5.

If CART.PARA., POLAR, or POLAR PARA. was selected, a range must be entered for the parameter T or for theta, for example, an expression like PI/2.

When entering expressions for X, Y, R or theta, be sure to use expressions of the appropriate independent variable: For Cartesian plots use X; for all the others use T. Be careful when using expressions involving powers, since powers of negative numbers are not valid on the ZX80/81. For example, when X is negative, use X*X instead of X**2.

Sample Curves

To illustrate the program, several interesting curves may be used. Two examples of each of the following types are given. The reader can get further variety by changing the constants. Many more examples of curves can be found in *A Catalog of Special Plane Curves* by J. Dennis Lawrence (Dover Publications, 1972).

Figure 2. Cartesian and polar representations of a point.

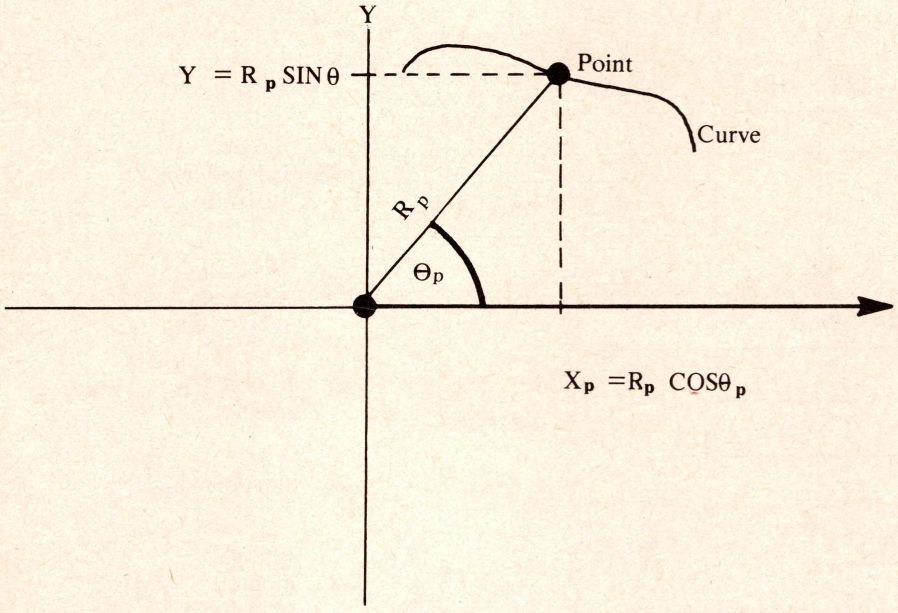


Figure 4. Curve-plotting program listing.

```
  20 PRINT "CART., CART. PARA.,
POLAR, OR POLAR PARA.? (1,2,3, O
R 4)"
  30 INPUT Z
  40 PRINT "PLOTTING WINDOW:"
  50 PRINT " INPUT XMIN,XMAX,YMI
N,YMAX"
  60 INPUT A
  70 INPUT B
  80 INPUT C
  90 INPUT D
 100 LET E=A
 110 LET F=B
 120 IF Z=1  THEN GOTO 200
 130 PRINT "PARAMETER/THETA RANG
E:"
 140 PRINT " INPUT MIN,MAX"
 150 INPUT E
 160 INPUT F
 170 IF Z=3 THEN GOTO 200
 180 PRINT " INPUT X/THETA EXPRE
SSION"
 190 INPUT A$
 200 PRINT " INPUT Y/R EXPESSION
"
 210 INPUT B$
 220 CLS
 230 FOR T=E TO F STEP (F-E)/200
 240 LET X=T
 250 IF Z=2 OR Z=4 THEN LET X=VA
L A$
 260 LET Y=VAL B$
 270 IF Z<3 THEN GOTO 300
 275 LET U=X
 280 LET X=Y*COS U
 290 LET Y=Y*SIN U
 300 IF X<A THEN LET X=A
 310 IF X>B THEN LET X=B
 320 IF Y<C THEN LET Y=C
 330 IF Y>D THEN LET Y=D
 340 PLOT (X-A)*60/(B-A),(Y-C)*4
0/(D-C)
 350 NEXT T
```

Make Your Sinclair Work Harder, Better...

with quality, affordable and dependable peripherals from CAI.

The Interface

The CAI/O Board® plugs into the computer's expansion port and is the interface that lets your computer communicate with the outside world.

There is a serial RS-232 compatible I/O port, 3 parallel I/O ports used to design circuits to control home lights, power relays and additional ports to accept printer, mass storage device and memory expansion.

$79.95 when purchased separately

$69.95 when purchased with CAI peripherals

The Printer

New! The CAI/P40 prints the complete library of regular and inverse alpha-numerics and graphics in 40-column width. Three user-addressable modes print in regular or enhanced (double type size): List program from memory, print text or data from program, print screen

$139.95 complete stand alone printer. (can be upgraded to use with other CAI peripherals)

$119.95 requires CAI/O Board for complete compatibility with other CAI peripherals

Mass Storage Device

CAI introduces the Stringy Floppy® for the Sinclair or Timex Sinclair. It has the speed of a disc drive at a fraction of the price. Data is stored on an inexpensive continuous loop magnetic tape cassette. This device inputs and outputs data at an incredible 14,000 baud - - 56 times faster than Sinclair cassette recorder interface.

The system is designed to accommodate two Stringy Floppy drives for even more versatility.

$109.95 per drive
Requires CAI/O Board

Computer Network Package

This package consists of ASCII conversion program, phone modem, connecting cable. Now you can communicate with large main frame computers, micro-and mini-computers and computer networking systems (The Source®).

$149.95 Note: Order this package when ordering your CAI/O Board.

$24.95 for ASCII conversion program only

Additional Peripherals

Memopak® 64K memory expansion
$159.95

Programs:

$14.95 **Home Finance**

$9.95 **Math Tutorial**

$9.95 **Stocks**

$9.95 **Wiz Bang Math**

$7.95 **Bio Rhythms**

Why buy from CAI?

All CAI peripherals come with complete instruction manuals, schematics and a 30-day unconditional replacement warranty. Each works with either the Sinclair ZX-80, ZX-81, MicroAce and Timex/Sinclair 1000.

Our technicians are happy to answer your questions before and after purchase.

CAI Instruments, Inc.
P.O. Box 2032
Midland, MI 48640

Phone: (517) 687-7343 Office Hours: 9:00 a.m. — 4:30 p.m.
Evening Hours (Technical Information) 6:00 p.m. — 8:30 p.m.

Orders accepted by phone or mail. For mail orders, send check, money order, VISA or MASTERCARD numbers. Foreign orders must be made in U.S. currency.

Quantity	Description	Unit Price	Total
	CAI/O Board	(See Price)	
	CAI Printer	(See Price)	
	Stringy Floppy	$109.95	
	Other		
SUBTOTAL			
Shipping and Handling			
4% Sales Tax (Michigan Resident Only)			
TOTAL			

☐ Literature, enclose $1.00

SHIPPING AND HANDLING CHARGES
Within U.S. $5.00 Outside U.S. — F.O.B. Midland, MI

MasterCard/Visa _____

Exp. Date _____

Name _____

Address _____

City _____ State _____ Zip _____

Phone No. _____

CAI/P40 Printer

CAI/O Board

Stringy Floppy

1. Lissajous Patterns. (See Figure 6.)

a. General form:

```
X=A*SIN(N*T+D)
Y=B*SIN T
```

b. This example:

```
A=B=1; D=0 ; N=.75
```

c. Program data:	ENTER:
CART.PARA.	2
XMIN,XMAX,YMIN,YMAX	-1,1,-1,1
PARAMETER RANGE	-20,20
X EXPRESSION	SIN (.75*T)
Y EXPRESSION	SIN T

2. Astroid. (See Figure 7.)

a. General form:

```
X=4*A*(COS T)**3
Y=4*A*(SIN T)**3
```

b. This example:

```
A=.25
```

c. Program data:	ENTER:
CART.PARA.	2
XMIN,XMAX,YMIN,YMAX	-1,1,-1,1
PARAMETER RANGE	-PI,PI
X EXPRESSION	COS T*COS T*COS T
Y EXPRESSION	SIN T*SIN T*SIN T

3. Limacon of Pascal.

a. General form:

```
R=2*ACOS T+B
```

b. This example:

```
A=B=1
```

c. Program data:	ENTER:
POLAR	3
XMIN,XMAX,YMIN,YMAX	-.5,3,-2,2
THETA RANGE	-PI,PI
R EXPRESSION	2*COS T+1

4. Rhodonea. (Figure 8.)

a. General form:

```
R=A*COS (N*T)
```

b. This example:

```
A=1; N=7
```

c. Program data:	ENTER:
POLAR	3
XMIN,XMAX,YMIN,YMAX	-1,1,-1,1
THETA RANGE	-PI,PI
R EXPRESSION	COS (7*T)

5. Serpentine. (Figure 9.

a. General form:

```
Y=X*B**2/(X**2+A**2)
```

b. This example:

```
A=2; B=6
```

c. Program data:	ENTER:
CART.	1
XMIN,XMAX,YMIN,YMAX	-10,10,÷10,10
PARAMETER RANGE	
Y EXPRESSION	(X*36)/(X*X+4)

6. Catenary.

a. General form:

```
Y=A/2*(EXP(X/A)+EXP(-X/A))
```

b. This example:

```
A=2
```

c. Program data:	ENTER:
CART.	1
XMIN,XMAX,YMIN,YMAX	-5,5,0,20
Y EXPRESSION	EXP (X/2)+EXP (-X/2)

7. Eight Curve.

a. General forms:

```
THETA=ATN SIN T
R=A*COS T*SQR (1+SIN T**2)
```

b. This example:

```
A=2
```

c. Program data:	ENTER:
POLAR PARA.	4
XMIN,XMAX,YMIN,YMAX	-2,2,-2,2
PARAMETER RANGE	-PI,PI
THETA EXPRESSION	ATN SIN T
R EXPRESSION	2*COS T*SQR (1+SIN T*SIN T)

8. Folium of Descartes.

a. General forms:

```
THETA ATN T
R=3*A*T*SQR (1+T**2)/(1+T**3)
```

b. This example:

```
A=5
```

c. Program data:	ENTER:
POLAR PARA.	4
XMIN,XMAX,YMIN,YMAX	-10,10,-10,10
PARAMETER RANGE	-5,5
THETA EXPRESSION	ATN T
R EXPRESSION	15*T*SQR (1+T*T)/(1+T*T*T)

9. Additional Examples:

a. Polynomial (CART.):

```
Y=A0+A1*X+A2*X**2+A3*
X**3+ +AN*X**N
```

b. Hypotrochoid (CART.PARA.):

```
X=N*COS T+H*COS (N*T/B)
Y=N*SIN T-H*SIN (N*T/B)
```

c. Epitrochoid (CART.PARA.):

```
X=N*COS T-H*COS (N*T/B)
Y=N*COS T-H*COS (N*T/B)
```

d. Archimedes' Spiral (POLAR):

```
R=A*T
```

e. Spirals (POLAR PARA.):

```
THETA=T**M
R=A*T
```

Figure 3.

Method	Independent Variable	Coordinates	Example
CARTESIAN	X	(X,Y) = (X,f(X))	Y=X**2 (PARABOLA)
CARTESIAN PARAMETRIC	T	(X,Y) = (f_1(T),f_2(T))	X=T (PARABOLA) Y=T**2
POLAR	THETA, or θ	(R,θ) = (f(θ),θ)	R=2*THETA (SPIRAL)
POLAR PARAMETIC	T	(R,θ = (f_1(T),f_2(T))	THETA=T (SPIRAL) R=2*T

"Touch-A-Matic™", Power At Your Finger Tips!

$9.95

KOPAK'S TOUCH-A-MATIC™ gives you the power to type more accurately and much faster. It requires no wires, no soldering. Comes with complete instructions. It's as easy as removing adhesive backing and pressing into position. Positioning is easy. Once in position, you are ready for touch-typing with ease.

Our unique vinyl-key-hold creation will guide your fingers to the correct keys. Finally, touch-typing now possible with your Sinclair* or Micro-Ace*.

This remarkable product, as well as other **KOPAK** items, are now available. Call now to order through MC/Visa or send check/M.O. to **Kopak Creations, Inc.**

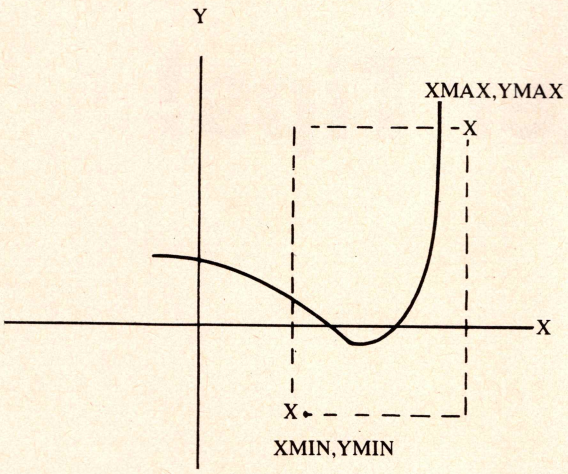
TM Trademark of KOPAK Creations, Inc.
Sinclair* is a trademark of Sinclair* Research LTD.
MicroAce* is a trademark of MicroAce*

KOPAK CREATIONS, INC.
(212) 757-8698
Master Charge & Visa Accepted

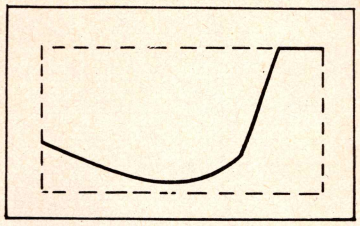
$1.50 Handling Charge

Dept. SY 2 448 West 55th Street, New York, NY 10019 (212) 757-8698

Figure 5.

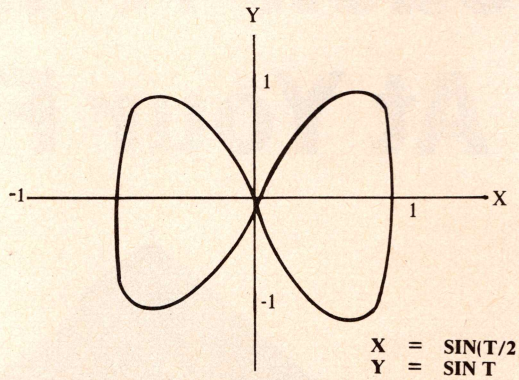


a) Plotting window.



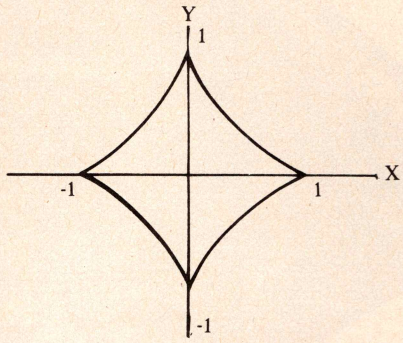
b) Resulting plot.

Figure 6. Lissajous Pattern.



X = SIN(T/2)
Y = SIN T

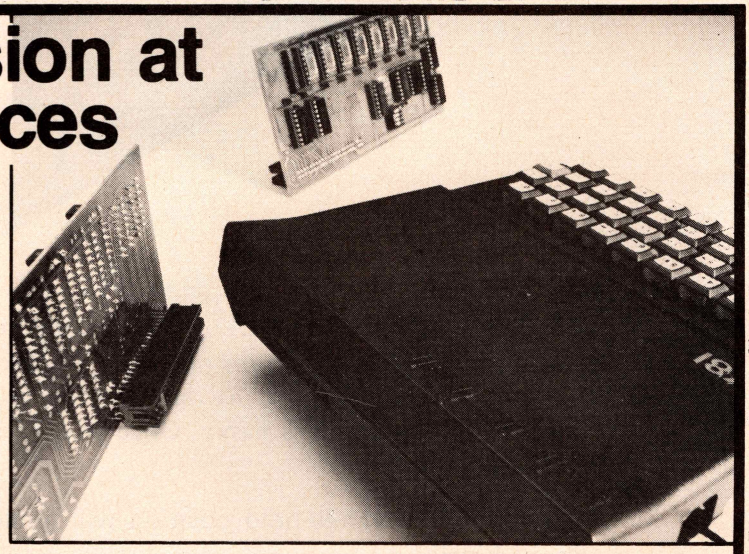
Figure 7. Asteroid.



X = COS^3T
Y = SIN^3T

Memory Expansion at Unexpanded Prices

- **16K Memory Expansion**
- Simply plugs into your Timex/Sinclair 1000
- Fully tested top quality products
- ***Price only $35.00***
- **64K Memory Expansion**
- Plugs into your Timex/Sinclair 1000
- Fully tested top quality products
- 56K of directly addressable memory
- 2 x 4K pages can be switched in or out for use with mapped memory peripherals ***Price only $110.00***



International money order or certified cheque inclusive of Postage and Packaging payable to Namal Associates

Namal Associates 25 Gwydir Street, Cambridge, CB1 2LG ENGLAND Telephone: (0223) 355404 Telex: 817445

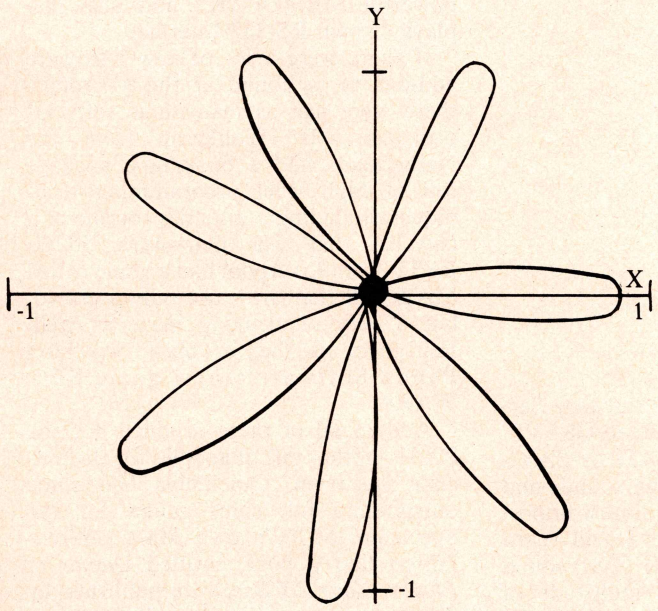
Please rush me (Quantity). . . . . 16K Memory Expansion@ $35.00
Please rush me (Quantity). . . . . 64K Memory Expansion@ $110.00
Add Postage and Packaging $4.50 I enclose $ .....

Name _____ Signature _____

Address _____

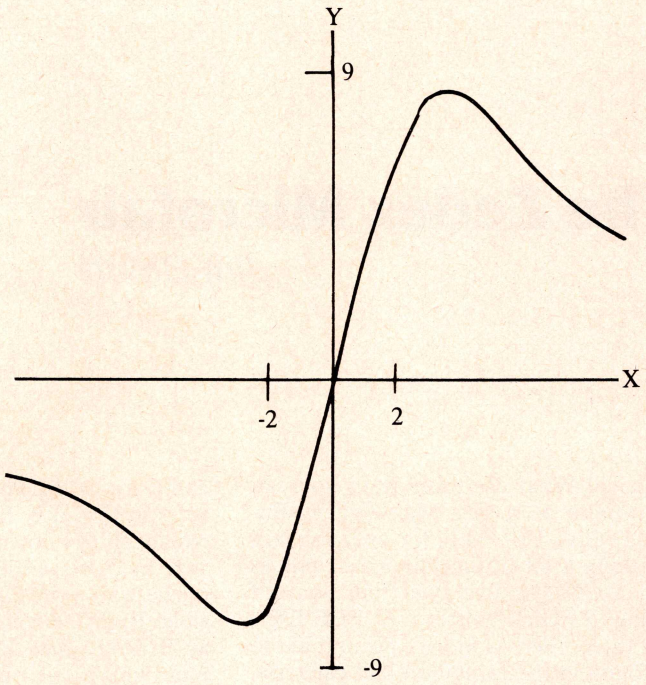
S. N. D. ME

Figure 8. Rhodonea.



$R=COS(7.\theta)$

Figure 9. Serpentine.



$$Y=\frac{36X}{X^2+4}$$

ADVENTURE

VOYAGER I-Voyage thru time and space in this new fantasy game. In Voyager I you will travel to Sangrel to find the rare element Valium for new Energy Weapons. Voyager I includes:

One key entry of commands
Over 16 Billion Characters
2 Sides of Adventure 16k each
Graphic display of status
Over 20 Encounters to deal with
Quality C-20 Cassette
Instructions Only $9.95

You may use one of your own Characters from your favorite Role Playing Game if you wish or you may use one of over 16 billion Characters.

*******VOYAGER II COMING SOON*******
Saveable in progress

Explorer I-You find a strange new world when you walk into a strange mist on your way home. This is a text adventure and is saveable in progress. $9.95

Explorer II-After a week back home once again you find yourself transported to a strange new world. Text adventure - Saveable in progress $9.95

Send for catalog with 1k to 16k programs. Postage is included in price. All programs come on a Quality C-20 Computer grade Cassette with instructions.

Send to: **Chris White**
789 S. Green Bay Road
Lake Forest, IL. 60045

Add Sound to Your ZX81!

Sounder circuit fits inside the ZX81/Timex 1000

No cutting, soldering, or unsoldering.

Circuit beeps when key inputs are accepted by the computer.

Send $12.00 per unit plus $2.00 postage and handling

(N.J. Residents add 5% Sales Tax)

to

KML Incorporated
P.O. Box 1147
New Brunswick, N.J. 08903

The Zedex Microfair

Jim Beloff

Quick! What are three ways you can tell you're at a ZX Microfair in England? Give Up? Well, for one, you will be seeing a lot of Sinclair Spectrums as well as ZX81s; two, you find yourself saying "ZEDEX" instead of "ZEE-EX"; and three, there is kidney pie and ale to be found in the exhibition hall cafeteria.

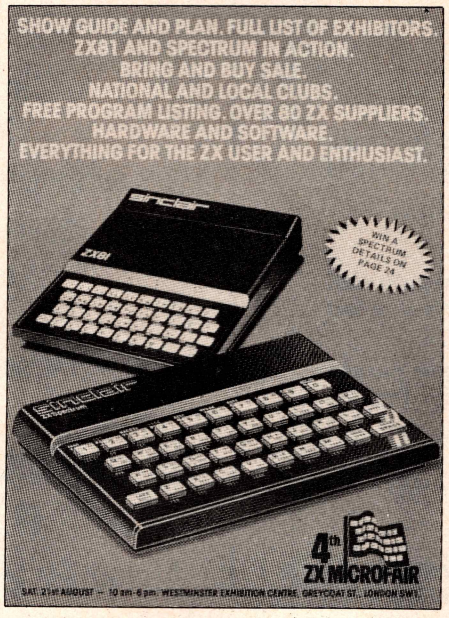
Had you been in London's Westminster Exhibition Centre on August 21, 1982, you might have seen, said, and tasted as I did. Sydney Rogers (Director of Marketing for Ahl Computing), Hazel Gordon (Creative Computing's U.K. representative), and I were at the Microfair representing *SYNC*, and happily succumbed to it all.

Touted as the "largest single display of ZX products under one roof anywhere," this 4th ZX Microfair more than lived up to its reputation. Organized by a rather jolly, beared Mike Johnston, the fair offered 80 tables worth of hardware, software, peripherals, books, etc. for the ZX81 and Sinclair Spectrum. Enough, in fact, to make one wish the fair were two days long instead of one.

If there were a lot of exhibitors at the fair, there were at least twenty times that many Sinclair owners. By 10 a.m. the line to get inside was two city blocks long, and by 11 a.m. getting through the aisles was like a game of MAZOGS (see below).

None of this, however, could stop me from feeling absolutely amazed at the sheer number of products available for this little $99 microcomputer, and how many of those seemed to be creative technical achievements comparable to the Sinclair computers themselves. Wherever someone has found a limitation in the ZX81, someone else has been bound and determined to find an antidote.

For example, loading a 16K program takes a few minutes. Right? Wrong! A company called Personal Software Services in Coventry has invented QSAVE, which allows you to LOAD or SAVE 16K in 29 seconds. Making sounds and music with your ZX81 is almost impossible. Right? Wrong again! David Ward at BI-PAK has the ZON X-81 sound unit which can make a multitude of sound effects and gives eight full octaves of tones. A company called Macronics has an interface for a disk drive, Kayde, Fuller Micro, and DK'Tronics have full keyboards that the ZX81 fits inside, the Kempston Electronics has KLIK-KEYBOARD that fits on the top of the membrane. JRS Software has a tripped down 16K rampack for $39.95, and Sir Computers has an interface card that lets your ZX81 run a robotic arm. You can turn your ZX81 into a business computer with the Cobra 1000 business system, and Dean Electronics has a brand new ZX81 compatible printer. Memotech continues to add to its growing line of powerful MEMOPAKS and also displays its own RS-232 Interface.



If there were a lot of new hardware add-ons to be found at the Microfair, there were just as many new software packages. Mr. Wolfkamp from the Netherlands had a book/tape package full of high level programming techniques, including a graphics routine of a bicyclist that was marvelous. BUG-BYTE from Liverpool had a game called MAZOGS that drew not only a crowd, but a very challenging maze as well. Fair-goers also had a "blast" watching Panda Software's new game SEA WARS.

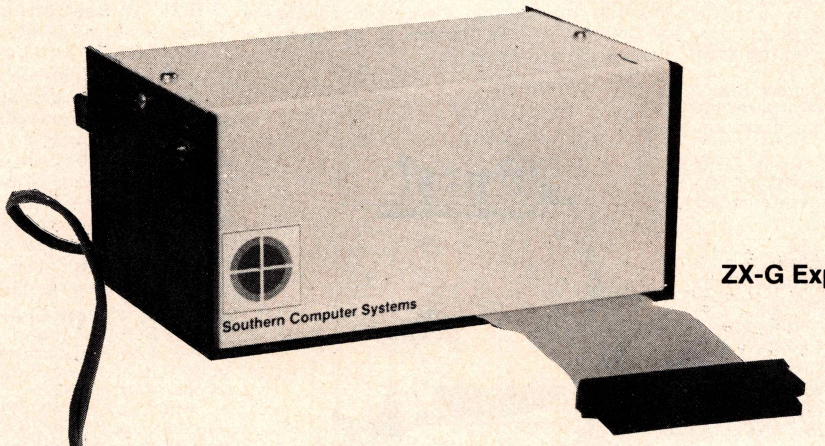
Add to all of these products for the ZX81 another raft of goodies for the Sinclair Spectrum. QuickSilva had some outstanding full color games for the Spectrum, *SYNC*'s own Martin Wren-Hilton had a book entitled *Games to Play on Your ZX Spectrum* published by Shiva. Almost every other exhibitor with ZX81 products had something available or "in the works" for the Spectrum. The combination of color, sound, and low price have made the Spectrum the hottest microcomputer in England, and certainly we will be looking forward to its coming to the U.S.

Perhaps the nicest part of the fair was getting to know some of the exhibitors and fair-goers themselves. In general, enthusiasts are a fun bunch, if only for the fact that they are, well, enthusiastic, but Sinclair enthusiasts are special. Somehow the feeling of "they say it can't be done so let's do it" type of ingenuity runs rampant throughout this group. Also, there seemed to be a lot of parents and children in attendance, and both groups seemed equally captivated by the goings-on.

The fair finally wound down about 6 p.m., and the exhibitors started packing up the televisions, the Sinclairs, the rampacks, hardware, software, books, etc. until the next ZX Microfair.

Then it dawned on me: there are something like 300,000 Sinclair Computer owners in the United States, more than in any other country. And there are close to as many manufacturers of Sinclair related products in the U.S. as there are in England. Why doesn't somebody organize a Sinclair Microfair for the United States owners? How about a show on the East coast, the Midwest, and the West Coast? Anyone out there up to the challenge? Well, it's a thought, and judging from the good time I had in London, a fun thought at that!

Sinclair Hi-Res Graphics + 48K RAM + 8K EPROM Programmer



ZX-G Expansion Unit

Plug into Extended Use

Introducing Hi-Resolution Graphics for the Sinclair ZX-81

Now you can create detailed graphics images with the new, high quality, low cost **ZX-G Expansion Unit.**

Quality Graphics

The ZX-G gives your ZX-81 the ability to create memory-mapped graphics images with a resolution of 256 X 192 pixels.

— Graphics images can be drawn, moved, rotated, mixed with text, saved on cassette or printed.
— Excellent for Computer Aided Design, education and games.

Powerful Software! (cassette included)

— Generate lines, circles, and rectangles with ease!
— A dynamic graphics cursor facilitates rapid design.
— Graphics animation is fully supported!

Memory Expansion!

— With the ZX-G, you can expand the memory of your computer to 48K!
— Up to four hi-res. graphics screens can be stored in addition to a 16K program!

EPROM Programmer Support!

— With our optional EPROM programmer, (fully transparent), 2716 (8K) EPROMs can be programmed, verified and run directly in memory map (2000-3FFFH)

Compact Design!

— The total unit (including power supply) is enclosed in an attractive vinyl-clad aluminum case.
— Cable and power cord included!
— 90 Day Warranty (parts & labor)

ZX-G Expansion Unit **$99.95**

RAM/EPROM Option **$79.95**
(includes 32K RAM + four 2716 EPROMs, ZX-G required)

Free Graphics Software

Mail Order to:

Southern Computer Systems
630 Main Street
Shelbyville, Kentucky 40065
or call collect: (502) 633-5640

AARDVARK — THE ADVENTURE PLACE

ADVENTURES FOR OSI, TRS-80, TRS-80 COLOR, SINCLAIR, PET, VIC-20

ADVENTURES — Adventures are a unique form of computer game. They let you spend 30 to 70 hours exploring and conquering a world you have never seen before. There is little or no luck in Adventuring. The rewards are for creative thinking, courage, and wise gambling — not fast reflexes.

In Adventuring, the computer speaks and listens to plain English. No prior knowledge of computers, special controls, or games is required so everyone enjoys them—even people who do not like computers.

Except for Quest, itself unique among Adventure games, Adventures are non-graphic. Adventures are more like a novel than a comic book or arcade game. It is like reading a particular exciting book where you are the main character.

All of the Adventures in this ad are in Basic. They are full featured, fully plotted adventures that will take a minimum of thirty hours (in several sittings) to play.

Adventuring requires 16k on Sinclair, TRS-80, and TRS-80 Color. They require 8k on OSI and 13k on VIC-20. Sinclair requires extended BASIC.

TREK ADVENTURE by Bob Retelle — This one takes place aboard a familiar starship and is a must for trekkies. The problem is a familiar one — The ship is in a "decaying orbit" (the Captain never could learn to park!) and the engines are out (You would think that in all those years, they would have learned to build some that didn't die once a week). Your options are to start the engine, save the ship, get off the ship, or die. Good Luck.

Authors note to players — I wrote this one with a concordance in hand. It is very accurate — and a lot of fun. It was nice to wander around the ship instead of watching it on T.V.

CIRCLE WORLD by Bob Anderson — The Alien culture has built a huge world in the shape of a ring circling their sun. They left behind some strange creatures and a lot of advanced technology. Unfortunately, the world is headed for destruction and it is your job to save it before it plunges into the sun!

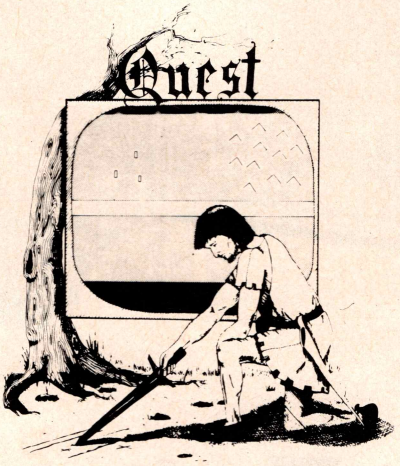
Editors note to players — In keeping with the large scale of Circle World, the author wrote a very large adventure. It has a lot of rooms and a lot of objects in them. It is a very convoluted, very complex adventure. One of our largest. Not available on OSI.

HAUNTED HOUSE by Bob Anderson — This one is for the kids. The house has ghosts, goblins, vampires and treasures — and problems designed for the 8 to 13 year old. This is a real adventure and does require some thinking and problem solving — but only for kids.

Authors note to players—This one was fun to write. The vocabulary and characters were designed for younger players and lots of things happen when they give the computer commands. This one teaches logical thought, mapping skills, and creativity while keeping their interest.

DERELICT by Rodger Olsen and Bob Anderson — For Wealth and Glory, you have to ransack a thousand year old space ship. You'll have to learn to speak their language and operate the machinery they left behind. The hardest problem of all is to live through it.

Authors note to players — This adventure is the new winner in the "Toughest Adventure at Aardvark Sweepstakes". Our most difficult problem in writing the adventure was to keep it logical and realistic. There are no irrational traps and sudden senseless deaths in Derelict. This ship was designed to be perfectly safe for its' builders. It just happens to be deadly to alien invaders like you.



NUCLEAR SUB by Bob Retelle — You start at the bottom of the ocean in a wrecked Nuclear Sub. There is literally no way to go but up. Save the ship, raise her, or get out of her before she blows or start WWIII.

Editors note to players—This was actually plotted by Rodger Olsen, Bob Retelle, and someone you don't know — Three of the nastiest minds in adventure writing. It is devious, wicked, and kills you often. The TRS-80 Color version has nice sound and special effects.

EARTHQUAKE by Bob Anderson and Rodger Olsen — A second kids adventure. You are trapped in a shopping center during an earthquake. There is a way out, but you need help. To save yourself, you have to be a hero and save others first.

Authors note to players — This one feels good. Not only is it designed for the younger set (see note on Haunted House), but it also plays nicely. Instead of killing, you have to save lives to win this one. The player must help others first if he/she is to survive — I like that.

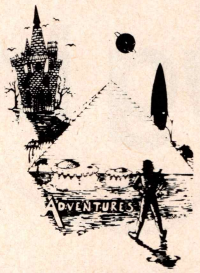
PYRAMID by Rodger Olsen — This is one of our toughest Adventures. Average time through the Pyramid is 50 to 70 hours. The old boys who built this Pyramid did not mean for it to be ransacked by people like you.

Authors note to players — This is a very entertaining and very tough adventure. I left clues everywhere but came up with some ingenous problems. This one has captivated people so much that I get calls daily from as far away as New Zealand and France from bleary eyed people who are stuck in the Pyramid and desperate for more clues.

QUEST by Bob Retelle and Rodger Olsen — THIS IS DIFFERENT FROM ALL THE OTHER GAMES OF ADVENTURE!!!! It is played on a computer generated map of Alesia. You lead a small band of adventurers on a mission to conquer the Citadel of Moorlock. You have to build an army and then arm and feed them by combat, bargaining, exploration of ruins and temples, and outright banditry. The game takes 2 to 5 hours to play and is different each time. The TRS-80 Color version has nice visual effects and sound. Not available on OSI. This is the most popular game we have ever published.

MARS by Rodger Olsen — Your ship crashed on the Red Planet and you have to get home. You will have to explore a Martian city, repair your ship and deal with possibly hostile aliens to get home again.

Authors note to players — This is highly recommended as a first adventure. It is in no way simple—playing time normally runs from 30 to 50 hours — but it is constructed in a more "open" manner to let you try out adventuring and get used to the game before you hit the really tough problems.



ADVENTURE WRITING/DEATHSHIP by Rodger Olsen — This is a data sheet showing how we do it. It is about 14 pages of detailed instructions how to write your own adventures. It contains the entire text of Deathship. Data sheet - $3.95. NOTE: Owners of OSI, TRS-80, TRS-80 Color, and Vic 20 computers can also get Deathship on tape for an additional $5.00.

PRICE AND AVAILABILITY:

All adventures are $14.95 on tape except Earthquake and Haunted House which are $9.95. Disk versions are available on OSI and TRS-80 Color for $2.00 additional.

Please specify system on all orders

ALSO FROM AARDVARK — This is only a partial list of what we carry. We have a lot of other games (particularly for the TRS-80 Color and OSI), business programs, blank tapes and disks and hardware. Send $1.00 for our complete catalog.

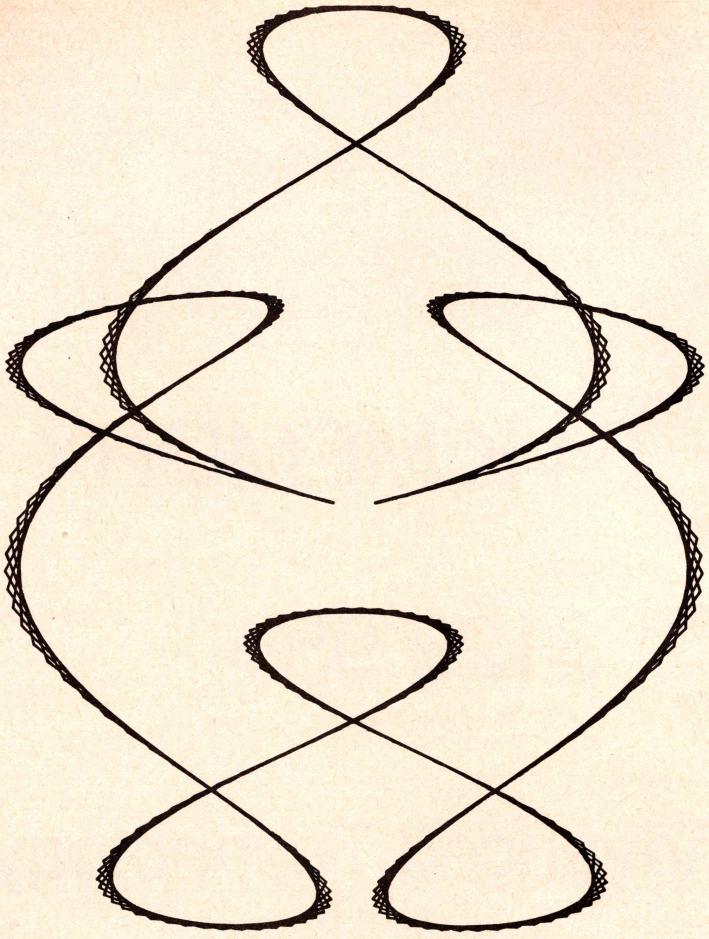
AARDVARK - 80
2352 S. Commerce, Walled Lake, MI 48088
(313) 669-3110

VISA

master charge

Phone Orders Accepted 8:00 a.m. to 4:00 p.m. EST. Mon.-Fri.

TRS-80 COLOR **SINCLAIR** **OSI** **VIC-20**



Meditations on a Hypotrochoid

Bradley Rogers

The plotting capacity of the ZX80(81) enables even the least artistically talented to create some pretty dazzling displays. The much denigrated sine and cosine functions conceal mathematical mysteries that are invisible to mere number crunchers.

Take the hypotrochoid. It is represented by a rather formidable mathematical expression, but it makes a marvellous propellor if displayed on your Sinclair.

$x = n \cos t + h \cos n/b\ t$

$y = n \sin t - h \sin n/b\ t$

In mathematical parlance, this is a parametric formula describing the hypotrochoid. X and Y are the coordinates of the graph which can be produced by means of the PLOT command. "t" is a variable representing the infinite number of angles a radius creates as it sweeps round a circle. "t" plays a part because a hypotrochoid is a line formed by a point fixed to a circle rolling along the inner side of a stationary circle. "n," "h," and "b" are parameters that are uniquely defined for each size and shape of hypotrochoid.

Although this description may seem a bit overwhelming to those allergic to mathematics, it translates into very simple programs. Try this:

```
10 LET T=0
20 LET T=T+.1
30 LET X=12*COS T+8*COS (4*T)
40 LET Y=12*SIN T-8*SIN (4*T)
50 PLOT X+30,Y+20
60 GOTO 20
```

This routine can be run in either SLOW or FAST mode. Whenever you want to stop the program and admire your handiwork, simply press the BREAK pedal. Beware, it takes a while for this program to cook, especially in the SLOW mode. Through successive iterations the lines are gradually filled in to form a continuous propellor.

The hypotrochoid expresses the elegant simplicity and exquisite symmetry trapped inside many algebraic expressions. Its formula also contains an infinite number of bizarre, fascinating, and sometimes whimsical figures that can be coaxed out by mathematical mutilation. For example, try altering lines 30, 40, and 50 in this fashion.

```
10 LET T=0
20 LET T=T+.1
30 LET X=12*COS T+4*COS (4*T)
40 LET Y=12*SIN T-8*SIN (4*T)
50 PLOT Y+30,X+20
60 GOTO 20
```

Surprise. The propellor has metamorphosed into a doll. A more intricate doll, a dancer I think, can be formed by the following alteration:

```
10 LET T=0
20 LET T=T+.1
30 LET X=12*COS T+8*COS (4*T)
40 LET Y=12*SIN T-8*SIN (9*T)
50 PLOT Y+30,X+20
60 GOTO 20
```

Note that in the last two examples I have reversed the X and Y plot position in order to rotate the display 90 degrees. I suppose that mathematically speaking, these figures are no longer hypotrochoids, but they are the result of meditations on a hypotrochoid. For something completely different, try this:

```
10 LET T=0
20 LET T=T+.1
30 LET X=6*COS T+8*COS (4*T+.5
)
40 LET Y=12*SIN T-4*SIN (4*T)
50 PLOT Y+30,X+20
60 GOTO 20
```

I call it the "angry cat." If you are fond of butterflies, try this galactic variety:

```
10 LET T=0
20 LET T=T+.1
30 LET X=6*COS T+8*COS (6*T)
40 LET Y=12*SIN T-4*SIN (6*T)
50 PLOT Y+30,X+20
60 GOTO 20
```

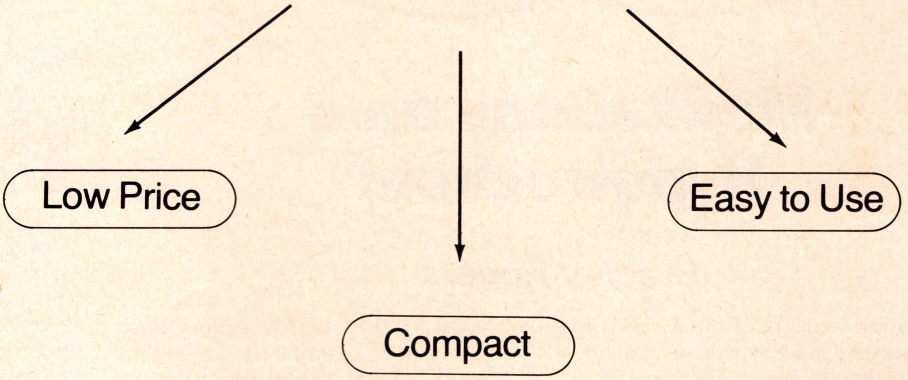
It is quite remarkable how resiliant this framework is. By means of seemingly random alterations, interesting forms emerge. Garbage is possible, but relatively rare. Try your hand and see what you come up with. It is a simple process of artistic experimentation. Be careful, however, not to choose large values for n and h that run the figure off the screen.

If you find this interesting, I highly recommend a book by J. Dennis Lawrence called *A Catalog of Special Plane Curves*. It is published as a durable paperback by Dover (New York, 1972). In it I discovered the hypotrochoid and its parametric representation. If you get excited by deltoids, hippopedes, rhodonea and nephroids, buy it. You can meditate and discover the inner harmonies of your computer. And, by the way, by drawing amusing and sometimes beautiful computer pictures, you may be able to convince your sceptical spouse or not easily impressed children that computers are not all that bad.

As a parting gesture, I give you "Acquatic Pegasus."

```
10 LET T=0
20 LET T=T+.1
30 LET X=12*COS T+8*COS (3*T+2
)
40 LET Y=12*SIN T-8*SIN (8*T)
50 PLOT Y+30,X+20
60 GOTO 20
```

Bradley Rogers, 16 Hepbourne St., Toronto, Ontario, Canada M6H 1J9.



64 K MEMORY

$129.95

New Advanced Technology

Low Price

Compact

Easy to Use

- Fits Sinclair ZX80, ZX81 and Timex - Sinclair 1000.
- First time offered - order early to avoid delays
- For orders Call Toll Free
  1-800-344-8211
  — Visa
  — Mastercard

COMPUTECH & SOFTWARE INDUSTRIES, Inc.

A Machine Code Graphics Line Drawing Subroutine

Daniel Kopyc

In the pages of the ZX81 manual, we find a Basic subroutine to draw a line between any two specified points (see Listing 1). However, I found this routine to be exceedingly slow, especially when I wanted to draw several lines on the screen and had to wait several agonizing minutes to get them. The only solution was to translate the Basic subroutine into Z80 machine language.

This was a fairly straightforward task as the Basic routine did not employ any complex mathematical functions or operations beyond ABS, SGN, subtraction and addition. I was able to find the address of the PLOT/UNPLOT routine in the 8K Basic ROM through the use of Bob Maunder's book, *The ZX81 Companion*. To plot a point on the screen, the C and B registers of the processor are loaded with the X and Y coordinates of the point to be plotted, respectively, and a call is made to the PLOT/UNPLOT routine at address BB2h. Location 4030h (16432d), T-ADDR in the system variables listed on p. 173 of the ZX81 manual, controls the color (black or white) of the plotted point, thus making the routine at BB2h selectively either PLOT or UNPLOT. A value of 0 in T-ADDR UNPLOTS, 4Bh PLOTS. This is demonstrated in the section of Line Draw at address 41A0h. I also wanted to make the Line Draw routine very user friendly and completely usable by the person who has either no knowledge of machine language at all or a severe phobia of PEEKs and POKEs. So, I added a short section of code to read out the values of five control variables from the variable storage section of the Basic interpreter (see Listing 3, at addresses 4082h through 40A5h).

Daniel Kopyc, Box 106, Trumansburg, NY 14886.

Listing 1 is from *ZX81 BASIC Programming* (1st ed., 1980), p. 121, and is provided for use as a subroutine in User written programs only.

To enter the Line Draw program, first type in the short Basic monitor program in Listing 2 (including the big REM statement) that we will use to enter, edit, and review the machine code for Line Draw. After entering the program just as it is shown, type LIST 10 so that the REM statement is scrolled off the screen and will not crash the system. The monitor that I am using here is developed out of my experience in working with the Apple II computer. I had found a monitor program that was easy to use and all around nifty. As a result I decided that the ZX81 should have that type of program, so I wrote a version for the ZX81 in Basic.

Enter the monitor program in Listing 2 and then type RUN. Every line after the prompt symbol (=) starts with a 4-digit hexadecimal address. The next character (the command character) may be either a G, meaning GOTO, or start executing the machine language program at the preceding address; an L, meaning LIST the contents of eight consective memory locations starting at the preceding address; or a :, which deposits the following eight, 2-digit, hexadecimal values, separated by one space, into consecutive memory locations starting with the specified address. Some examples are given in Listing 4. This monitor program will be helpful in entering and debugging machine language programs other than just Line Draw, so you might want to save a version on tape.

Listing 1. Line-Draw Program in Basic.

```
1000 LET U=C-A
1005 REM U SHOWS HOW MANY STEPS
ALONG WE NEED TO GO
1010 LET V=D-B
1015 REM V SHOWS HOW MANY STEPS
UP
1020 LET D1X=SGN U
1030 LET D1Y=SGN V
1035 REM (D1X,D1Y) IS A SINGLE
STEP IN A DIAGONAL DIRECTION
1040 LET D2X=SGN U
1050 LET D2Y=0
1055 REM (D2X,D2Y) IS A SINGLE
STEP LEFT OR RIGHT
1060 LET M=ABS U
1070 LET N=ABS V
1080 IF M>N THEN GOTO 1130
1090 LET D2X=0
1100 LET D2Y=SGN V
1105 REM NOW (D2X,D2Y) IS A SING
LE STEP UP OR DOWN
1110 LET M=ABS V
1120 LET N=ABS U
1130 REM M IS THE LARGER OF ABS
U AND ABS V, N IS THE SMALLER
1140 LET S=INT (M/2)
1145 REM WE WANT TO MOVE FROM (A
,B) TO (C,D) IN M STEPS USING N
UP-DOWN OR RIGHT-LEFT STEPS D2,
AND M-N DIAGONAL STEPS D1, DISTR
IBUTED AS EVENLY AS POSSIBLE
1150 FOR I=0 TO M
1160 PLOT A,B
1170 LET S=S+N
1180 IF S<M THEN GOTO 1230
1190 LET S=S-M
1200 LET A=A+D1X
1210 LET B=B+D1Y
1215 REM A DIAGONAL STEP
1220 GOTO 1250
1230 LET A=A+D2X
1240 LET B=B+D2Y
1245 REM AN UP-DOWN OR RIGHT-LEF
T STEP
1250 NEXT I
1260 RETURN
```

Listing 2. A ZX Monitor Program.

```
   1 REM 1234567890ABCDEF1234567
890ABCDEF1234567890ABCDEF1234567
890ABCDEF1234567890ABCDEF1234567
890ABCDEF1234567890ABCDEF1234567
890ABCDEF1234567890ABCDEF1234567
890ABCDEF1234567890ABCDEF1234567
890ABCDEF1234567890ABCDEF1234567
890ABCDEF1234567890ABCDEF1234567
890ABCDEF1234567890ABCDEF1234567
890ABCDEF
  10 IF PEEK 16442=4 THEN CLS
  20 LET C=0
  30 PRINT
  40 PRINT ">>";
  50 INPUT A$
  60 PRINT A$;
  70 FOR A=1 TO 4
  80 LET C=C+16**(4-A)*(CODE A$(
A TO A)-28)
  90 NEXT A
 100 LET Q$=A$(5 TO 5)
 110 GOTO (Q$=":")*200+(Q$="L")*
300+(Q$="G")*400
 200 FOR D=6 TO LEN A$ STEP 3
 210 POKE INT (C+((D-6)/3)),(16*
(CODE A$(D TO D)-28))+CODE A$(D+
1 TO D+1)-28
 220 NEXT D
 230 GOTO 10
 300 PRINT " (";C;")"
 310 PRINT " ";
 320 PRINT A$(1 TO 4);":";
 330 FOR F=C TO C+7
 340 LET R=PEEK F
 350 LET M=INT (R/16)
 360 PRINT CHR$ (M+28);CHR$ (R-
*16+28);" ";
 370 NEXT F
 380 GOTO 10
 400 PRINT "(BC=";USR C;")";
 410 GOTO 10
```

SINWARE provides these high-quality machine-code programs for the TS1000 or ZX81.

HOT Z

HOT Z is a machine-programming editor with a debugger and disassembler that help take the mystery out of assembly language. A cursor-driven command system provides an interactive programming environment for entering, revising and relocating code. Full-screen listings with user labels let you understand other programs and capture the power of ROM routines for your own programs. An indispensable tool for learning how the black box works.

HOT Z loads, saves and runs your ZX printer or Memotech port for program documentation. **HOT Z**'s detailed instructions are ideal for the beginner or part-timer.

HOT Z is available on cassette in different versions for 16K or 32K+. Please specify.

Z EXTRA

Z EXTRA is a display creator/controller that makes you a master of ZX graphics and displays. No programming is required to create, save, print or display multiple screens of text and graphics.

Z EXTRA features blinking cursors, repeating keys, four write directions, eight plot directions, 4x4 and 8x8 character sizes, and full-screen editing capability.

Z EXTRA's displays provide horizontal or vertical scrolls of multiple screens against a background screen, or timed page flips for simple animation. Screens can be transferred to BASIC strings to save hours of fussy programming.

Z EXTRA turns your ZX81 into an electronic notebook for free-form lists, formatted data files, data displays, moving bilboards, or just for fun.

Z EXTRA requires a ZX81 or TS1000 with at least 16K or RAM and is especially useful with 64K. Just $19.95 on cassette.

SINWARE
BOX 323, DIXON, NM 87527

Listing 3. Assembly Language Line-Draw Program.

```
4Ø82H: DD 21 3C 4Ø     LD IX,VA          ;LOAD VARIABLES FROM
       2A 1Ø 4Ø        LD HL,(VARS)      ;AREA IN MEMORY AND
       Ø6 Ø5           LD B,Ø5           ;STORE IN SINGLE-BYTE
4Ø8BH: 23              INC HL            ;RESERVED LOCATIONS
       7E              LD A,(HL)         ;SEE VARIABLE MAP AT
       D6 8Ø           SUB 8ØH           ;END OF THIS LISTING
       23              INC HL
       16 ØØ           LD D,ØØ
4Ø92H: 5E              LD E,(HL)
       CB FB           SET 7,E
4Ø95H: CB 23           SLA E
       CB 12           RL D
       3D              DEC A
       2Ø F9           JR NZ,4Ø95H
       DD 72 ØØ        LD (IX+Ø),D
       DD 23           INC IX
4ØA1H: 23              INC HL
       23              INC HL
       23              INC HL
       23              INC HL
       23              INC HL
       1Ø E4           DJNZ,4Ø8BH
       3A 3C 4Ø        LD A,(VA)         ;LET U=C-A
       47              LD B,A
       3A 3E 4Ø        LD A,(VC)
4ØAEH: 9Ø              SUB B
       32 5Ø 4Ø        LD (VU),A
       3A 3D 4Ø        LD A,(VB)         ;LET V=D-B
       47              LD B,A
       3A 3F 4Ø        LD A,(VD)
       9Ø              SUB B
       32 41 4Ø        LD (VV),A
       3A 5Ø 4Ø        LD A,(VU)         ;LET D1X=SGN U
4ØCØH: CD 88 41        CALL 4188H
       32 44 4Ø        LD (VD1X),A
       32 46 4Ø        LD (VD2X),A       ;LET D2X=SGN U
       3A 41 4Ø        LD A,(VV)         ;LET D1Y=SGN V
       CD 88 41        CALL 4188H
       32 45 4Ø        LD (VD1Y),A
       3E ØØ           LD A,ØØ           ;LET D2Y=Ø
       32 47 4Ø        LD (VD2Y),A
4ØD7H: 3A 5Ø 4Ø        LD A,(VU)         ;LET M=ABS U
       CD 98 41        CALL 4198H
       32 42 4Ø        LD (VM),A
       3A 41 4Ø        LD A,(VV)         ;LET N=ABS V
       CD 98 41        CALL 9841H
       32 43 4Ø        LD (VN),A
       3A 42 4Ø        LD A,(VM)         ;IF M>N THEN GOTO LINE
       47              LD B,A            ;NUMBER 113Ø
4ØEDH: 3A 43 4Ø        LD A,(VN)
       B8              CP B
       38 1C           JR C,41ØFH
       3A 41 4Ø        LD A,(VV)
       CD 88 41        CALL 4188H
       32 47 4Ø        LD (VD2Y),A       ;LET D2Y=SGN V
       3E ØØ           LD A,ØØ           ;LET D2X=Ø
       32 46 4Ø        LD (VD2X),A
       3A 43 4Ø        LD A,(VN)         ;LET M=ABS V
       47              LD B,A            ;LET N=ABS U
       3A 42 4Ø        LD A,(VM)         ;(IN EFFECT, EXCHANGE M&N)
       32 43 4Ø        LD (VN),A
       78              LD A,B
       32 42 4Ø        LD (VM),A
41ØFH: 3A 42 4Ø        LD A,(VM)         ;LINE NUMBER 113Ø
       CB 3F           SRL A             ;LET S=(M/2)
       32 48 4Ø        LD (VS),A
       3E ØØ           LD A,ØØ           ;FOR I=Ø TO M
       32 49 4Ø        LD (VI),A
```

```
411CH: ED 4B 3C 4Ø      LD BC,(VA)          ;PLOT A,B
       ED 43 36 4Ø      LD (COORDS),BC
       CD AØ 41         CALL 41AØH
       3A 43 4Ø         LD A,(VN)           ;LET S=S+N
       47               LD B,A
       3A 48 4Ø         LD A,(VS)
       8Ø               ADD A,B
       32 48 4Ø         LD (VS),A
       3A 42 4Ø         LD A,(VM)           ;IF S<M THEN GOTO 123Ø
       47               LD B,A
       3A 48 4Ø         LD A,(VS)
       B8               CP B
       38 1C            JR C,4158H
       9Ø               SUB B               ;LET S=S-M
       32 48 4Ø         LD (VS),A
       3A 3C 4Ø         LD A,(VA)           ;LET A=A+D1X
       47               LD B,A
       3A 44 4Ø         LD A,(VD1X)
       8Ø               ADD A,B
       32 3C 4Ø         LD (VA),A
       3A 3D 4Ø         LD A,(VB)           ;LET B=B+D1Y
       47               LD B,A
       3A 45 4Ø         LD A,(VD1Y)
       8Ø               ADD A,B
       32 3D 4Ø         LD (VB),A
       18 16            JR 416EH            ;GOTO 125Ø
4158H: 3A 3C 4Ø         LD A,(VA)           ;LET A=A+D2X
       47               LD B,A
       3A 46 4Ø         LD A,(VD2X)
       8Ø               ADD A,B
416ØH: 32 3C 4Ø         LD (VA),A
       3A 3D 4Ø         LD A,(VB)           ;LET B=B+D2Y
       47               LD B,A
       3A 47 4Ø         LD A,(VD2Y)

416AH: 8Ø               ADD A,B
       32 3D 4Ø         LD (VB),A
416EH: 3A 42 4Ø         LD A,(VM)           ;LINE NUMBER 125Ø
       47               LD B,A              ;NEXT I
       3A 49 4Ø         LD A,(VI)
       3C               INC A
       32 49 4Ø         LD (VI),A
       B8               CP B
       DA 1C 41         JP C,411CH
       C9               RET                 ;RETURN TO CALLING PROGRAM

4188H: FE ØØ            CP ØØH              ;SIGNUM (SGN) SUBROUTINE
       2Ø Ø1            JR NZ,418DH         ;CALL WITH ARGUMENT IN A
       C9               RET                 ;REGISTER
418DH: FA 93 41         JP M,4193H          ;LEAVES RESULT IN A REG.
       3E Ø1            LD A,Ø1H
       C9               RET
4192H: 3E FF            LD A,FFH
       C9               RET

4198H: CB 7F            BIT 7,A             ;ABSOLUTE VALUE (ABS) ROUTINE
       28 Ø3            JR Z,419FH          ;CALL SAME WAY AS SIGNUM (ABOVE)
       2F               CPL
       C6 Ø1            ADD A,Ø1H
419FH: C9               RET

41AØH: 3A 4Ø 4Ø         LD A,(VPL)          ;PLOT ROUTINE
       FE ØØ            CP ØØH              ;SETS UP COLOR VARIABLE
       28 Ø2            JR Z,41A9H          ;AND MAKE MONITOR CALL
       3E 4B            LD A,4BH            ;TO BB2H
41A9H: 32 3Ø 4Ø         LD (4Ø3ØH),A
       CD B2 ØB         CALL BB2H
       C9               RET
```


Sinclair Software SourceBook
list
YOUR SOFTWARE
now for the February catalog
SELL IT—SHARE IT
You made it to fit your specific needs and it will meet the needs of **thousands of other Sinclair users** who will
ORDER FROM YOU AT YOUR PRICE

software category
☐ Business Applications
☐ Educational
☐ Games
☐ Industrial
☐ Home

Special Hardware if needed

designed for
☐ ZX80
☐ ZX 81/Timex Sinclair 1000

minimum of
☐ 1 k ☐ 32 k
☐ 2 k ☐ 48 k
☐ 16 k ☐ 64 k

Brief description (200 characters max.)

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

Available as
☐ Cassette $ _____ (US)
☐ source list $ _____ (US)

Name _____
Address . . . . . .
Street & # . . . . . .
State/Prov _____
Zip/Postal code . . . . . .

☐ Listing(s)
$10 per listing .00
☐ Purchase ___ copy(s)
Sinclair Software
Sourcebook ($8 ea) .00
☐ Check or Money order
☐ Visa or Mastercharge
_____
exp ___/___ TOTAL ___

Drivers Software Sourcebooks
5040 Ocatillo Rd.
Las Cruces, NM 88001

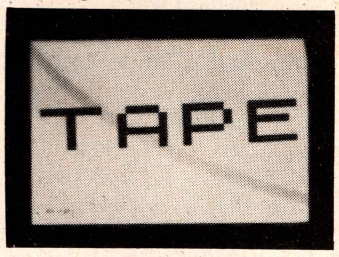
WORKS WITH ALL MEMORY SIZES!

FOR THE TIMEX-SINCLAIR 1000, ZX81, (AND ZX80 WITH 8K ROM)!

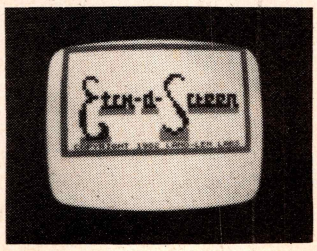
THE ZX81 HOME COMPUTER PACKAGE

ETCH-A-SCREEN

Easily paint pictures anywhere within the top 17 rows. A moving cursor travels up, down, right, left, even diagonally, leaving behind text, graphics, and inverse characters. Keys REPEAT while held down. Your drawing can be stored on tape... and immediately appears when reloaded. Perfect for designing screen logos, or just doodling on the screen



COMPOSER



BILLBOARD

Use BILLBOARD for messages, displays, and exhibits. Type in a message of up to 250 letters, and press ENTER. A row of giant letters moves smoothly across the screen, repeating your message until you press NEW and enter a new message. Or, press SAVE and store the message on tape. When reloaded, the message begins automatically.

CHECKBOOK BALANCER

Keep a running tabulation of your bank account. CHECKBOOK BALANCER displays your current checkbook balance, (up to $59,999.99), your latest account balance, and a list of up to 22 transactions which haven't cleared the bank. A plastic-coated keyboard overlay defines ENTER, VOID, CLEAR, and DISPLAY keys. And a SAVE key stores the updated program on tape.

A keyboard overlay transforms your computer into a four-octave musical instrument which broadcasts music as the keyboard is played. Listen to the music through a radio placed beside the computer, or through an amplifier and speakers. Or record the music directly onto tape. The last 175 notes played are stored in memory, and can be played back or edited. EDIT keys let you change notes and single-step forward or backward through the piece. SPECIAL EFFECTS keys are used to create unusual sound effects like laser blasts and arcade noises.

The complete ZX81 HOME COMPUTER PACKAGE, including cassette of four programs, manual, guide cards, screen display sheet, musical score sheet, and TWO FULL-COLOR KEYBOARD OVERLAYS, is just $9.95. Shipping and handling included! **$9.95**

From: LAMO-LEM LABORATORIES, CODE209, BOX 2382, LA JOLLA, CA 92038

For the ZX81, TIMEX-SINCLAIR 1000, and 8K ROM ZX80 or MicroAce

ITEM	PRICE	QTY
ZX81 HOME COMPUTER PACKAGE	$9.95	
ZX81 CLASSICS	$9.95	
ZX81 DISASSEMBLER	$9.95	
TOTAL		

NAME _____

ADDRESS _____

CITY _____

STATE/ZIP _____

Our catalog, with screen display and coding sheets, is free!

Now that you know how to use the monitor program, you may proceed to type in the entire listing of Line Draw as shown in Listing 5 using the deposit (:) command. It may take you until midnight, but do not despair because the results will be well worth the time and trouble. When you are finished, type ENTER to exit from the monitor, and SAVE the program at least twice, due to the sometimes unpredictability of the Sinclair SAVE, and type in the additional test lines as shown in Listing 6.

Now comes the moment of truth. Type RUN 1000. If no line appears on your screen almost immediately from the bottom left-hand corner to the top right-hand corner, or worse yet, your system crashes, you must reLOAD from tape, reenter the monitor by typing RUN, and carefully recheck your coding. It is helpful to have a friend to dictate the listing while you look at the screen otherwise you are constantly losing your place. If, however, the program does work successfully, espe-

Listing 4. Example Lists, GOTOs, and Deposits for ZX Monitor.

))4082L (16514d)	List out 8 consecutive memory locations beginning with address 4082h. As shown, location 4082h would hold the value AAh, 4083h holds BBh, etc. The list command also displays the decimal equivalent of the specified address, in this case 16514d. This is useful when calling your machine program from a Basic program using the USR() function, i.e., LET L=USR(16514).
))4082G (BC=0001)	GOTO location 4082h and start executing the machine language program there. The GOTO command also displays the contents of the BC register pair in the Z80 processor, which is what is left in the USR variable after calling from a Basic program.
))4082:22 33 44 55	Deposit the following 2-digit hexadecimal values separated by one space into consecutive memory locations beginning with the specified address 4082h.
))4082L (16514d) 22 33 44 55 EE FF 00 11	If we now do another LIST command, we can examine our changes.
	You are now ready to have some fun on your own with more examples.

Listing 5. ZX Monitor Deposit Commands for Entering Line-Draw.

```
4082:DD 21 3C 40 2A 10 40 06
408A:05 23 7E D6 80 23 16 00
4092:5E CB FB CB 23 CB 12 3D
409A:20 F9 DD 72 00 DD 23 23
40A2:23 23 23 10 E4 3A 3C 40
40AA:47 3A 3E 40 90 32 50 40
40B2:3A 3D 40 47 3A 3F 40 90
40BA:32 41 40 3A 50 40 CD 88
40C2:41 32 44 40 32 46 40 3A
40CA:41 40 CD 88 41 32 45 40
40D2:3E 00 32 47 40 3A 50 40
40DA:CD 98 41 32 42 40 3A 41
40E2:40 CD 98 41 32 43 40 3A
40EA:42 40 47 3A 43 40 B8 38
40F2:1C 3A 41 40 CD 88 41 32
40FA:47 40 3E 00 32 46 40 3A
4102:43 40 47 3A 42 40 32 43
410A:40 78 32 42 40 3A 42 40
4112:CB 3F 32 48 40 3E 00 32
411A:49 40 ED 4B 3C 40 ED 43
4122:36 40 CD A0 41 3A 43 40
412A:47 3A 48 40 80 32 48 40
4132:3A 42 40 47 3A 48 40 B8
413A:38 1C 90 32 48 40 3A 3C
4142:40 47 3A 44 40 80 32 3C
414A:40 3A 3D 40 47 3A 45 40
4152:80 32 3D 40 18 16 3A 3C
415A:40 47 3A 46 40 80 32 3C
4162:40 3A 3D 40 47 3A 47 40
416A:80 32 3D 40 3A 42 40 47
4172:3A 49 40 3C 32 49 40 B8
417A:DA 1C 41 C9
4188:FE 00 20 01 C9 FA 93 41
4190:3E 01 C9 3E FF C9
4198:CB 7F 28 03 2F C6 01 C9
41A0:3A 40 40 FE 00 28 02 3E
41A8:4B 32 30 40 CD B2 0B C9
```


IMPORTED GAME CASSETTES
ZX81 16K $14.95 EACH
"TRADER JACK" FANTASTIC FUN GAME.
BUSINESS LOGIC — SOUTH PACIFIC LOCAL.
"ZX81 MONOPOLY" UP TO 6 PLAYERS.
SPECIFY EITHER SPANISH, BRITISH OR AMERICAN LANGUAGE VERSION.
SAVAGE SOFTWARE, PO BOX 441
TITUSVILLE, FL. 32780

The Troiano Software Company is now offering for the ZX81 a graphics, games, accounting, math and utility package with 12 programs in all! Only $4.00.
Troiano Software Company
PO Box 40
Nesconset, New York 11767

CAR LOG
A new USEFUL suite of professional programs for the ZX81(16K).
1.) Very simple to use with full instructions.
2.) Complete cassette record of mileage and itemised expenses.
3.) All conceivable ratios, totals and projections computed.
CAR LOG is suitable for your car, your dad's car or your whole fleet of trucks.
Only $14.95
NIMROD SORTWARE
4 Stanley Rd.,
London, SW14 7DZ U.K.

ZX-81 SOFTWARE WRITERS
If you have useful applications for business, education, engineering or unique exciting games you could earn good money. Submit programs on cassettes or write details to:
FRESH TRACKS 27 W. Rayburn Road, Millington, N.J. 07946. Phone A/C 201 647-0970. Prompt reply.

ZX TYPING TUTOR
- LEARN ALPHA NUMERIC KEYBOARD
- THREE SKILL LEVELS
- INSTANT FEEDBACK AND FINAL SCORE
- GET THIS HIGH PERFORMANCE 8K/16K LISTING AT BIG SAVINGS.
- ONLY $4.95 FROM:

MICRO-TECH
1019 BRANDON LAKES AVE.
VALRICO, FLORIDA 33594

SINCLAIR ZX81 & TS1000 SOFTWARE
Fifty games for less than $2 ea.
Send SASE for FREE catalog to:
BIOCAL SOFTWARE
340 Cypress Dr.
Fairfax, Calif. 94930

SANTE FE INDUSTRIES-soon to be the biggest name in software/hardware for the Timex/Sinclair and Commodore Computers. Will send you (for $3.00 s & h) software/hardware information on, 16K RAM, I/O, Rtty, CW, Satellite antenna pointing, contest logging, accounting, inventory, classroom, mail list, etc. included-over 30 1K ZX/Timex programs, ZX80 to 81 conversions, error table. **SANTA FE** 2342 S. Dundee CT., Highland, MI. 48031
SIMPLY THE BEST!

cially the first time, you are eligible for the award for BEST-TYPER-OF-THE-YEAR. Now carefully delete each line of the Basic monitor program (remember never to type LIST, only LIST 10) all the way to line 1060 starting with line 10 by typing in the line number followed by ENTER. Now carefully SAVE this final version at least twice. To use this final version of Line Draw, all you do is set aside five variables (i.e., A-E) in your Basic program and set them to zero with the LET statement at the very top of your program (i.e., line 10). Do not declare any other variables before these five in order that Line Draw will be able to correctly find them. When you wish to plot a line during the course of your program, simply set the first two control variables (A and B) to the X and Y coordinates of the first endpoint of the desired line, the second two variables (C and D) to the coordinates of the second endpoint and the fifth variable (E) to 0 if you want to unplot the line, or to 1 to plot the line. Super simple, super fast. Some additional program examples to try with Line Draw are found in Listing 7.

Listing 6. Additional Basic Lines for Testing Line Draw.

```
1000 LET A    0          (1st X coordinate)
1010 LET B    0          (1st Y coordinate)
1020 LET C    63         (2nd X coordinate)
1030 LET D    43         (2nd Y coordinate)
1040 LET E    1          (Set plot to black)
1050 LET L    USR 16514  (Call machine
                          routine to draw
                          line from A,B
                          to C,D)
1060 STOP                (Done)

RUN 1000
```

(A line should immediately appear on the screen from 0,0 to 63,43)

Listing 7. Additional Example Programs for Line-Draw.

```
 10 REM ASTERISK
 20 LET A=0
 30 LET B=0
 40 LET C=0
 50 LET D=0
 60 LET E=1
 70 FOR Y=0 TO 43 STEP 5
 80 LET A=0
 90 LET B=Y
100 LET C=63
110 LET D=43-Y
120 LET L=USR 16514
130 NEXT Y
140 FOR X=0 TO 63 STEP 5
150 LET A=X
160 LET B=0
170 LET C=63-X
180 LET D=43
190 LET L=USR 16514
200 NEXT X

 10 REM SHAPE-DRAW
 20 LET A=0
 30 LET B=0
 40 LET C=0
 50 LET D=0
 60 LET E=0
 70 LET A$=" (SEE EXPLANATORY T
EXT) "
 80 FOR X=1 TO LEN A$ STEP 10
 90 LET A=VAL A$(X TO X+1)
100 LET B=VAL A$(X+2 TO X+3)
110 LET C=VAL A$(X+4 TO X+5)
120 LET D=VAL A$(X+6 TO X+7)
130 LET E=0
140 IF A$(X+8)="P" THEN LET E=1
150 LET L=USR 16514
160 NEXT X
```

Note: The Shape Draw program draws a shape on the screen given endpoints of lines that define the shape desired coded into the text of the variable A$. For each line to be drawn, the endpoints are specified and PLOT/UNPLOT is selected by the letters P or U respectively. For example, to draw a box on the screen the following data could be put in A$: "00001000P 10001010P 10100010P 00100000P".

Get on the Control Bus for only $49.95 round trip

. . . and be on TIME.

With our real Time Clock and Calendar

8 lines departing
(outputs capable of driving relays)
8 lines arriving
(T T L compatible inputs)

TIME MONTH DATE YEAR DAY OF WEEK
23:59:59 12 - 31 - 99 - 7

- **Leap year correction**
- **12/24 hour format**
- **± 30 second time correction (hardware or software)**
- **Battery back-up circuit**

Comes complete with:
- All software needed to operate clock and Input/Output ports
- On board 5 volt regulator.
- Feed through Sinclair Bus connector to allow normal expansion.
- Each port is expandable through Multiplexing.
- I/O ports and other controls mate with Radio Shack™ 44 pin edge socket.
- 90 day Warranty

Accessories used with I/O Board:
- A to D and D to A converter
- Wireless control system compatible with BSR™ modules
- Solid state 25 amp switch modules
- 8 SPDT 5 amp relay card

Future products used with I/O board:
- Touch Tone™ encoder/decoder and other telephone products
- Speech synthesizer
- Sound synthesizer

Compatible with ZX80/81 MicroAce & TIMEX™ 1000
All accessories can be connected together and separately controlled from the I/O Ports

Model	Description	Price
310	I/O port with real time clock **(Built and tested)**	$49.95
315	PC board and manual of #310	$24.95
320	A to D and D to A converter **(Built and tested)**	$39.95
325	Bare A to D and D to A board and manual	$19.95
330	Wireless control system **(Built and tested)**	$54.95
340	Solid State™ AC switch **(Built and tested)**	$19.95
350	Relay board **(Built and tested)**	$69.95
317	Clock IC and crystal **(Tested)**	$12.95
	Shipping and handling	$ 3.95

Orders accepted by phone or mail. California residents add 6% tax
For mail orders, send check or money order.
Foreign orders must be in U.S. currency.

write for free catalog

JK AUDIO

P.O. Box 3295
Escondido, CA 92025-0580
Information (619) 741-5132
24 HOUR ORDER LINE ONLY
NAT. 800-227-1617 **(No catalog calls please)**
Calif. Res. 800-772-3545
Ask for operator 367

VISA MasterCard

SOFTWARE BY C.E.D.CORPORATION

E-Z BOOKKEEPING FOR SMALL BUSINESS (TAKES LESS THAN ½ HOUR PER MONTH). ALSO GOOD FOR HOUSEHOLD BUDGETING.

CHECKING ACCOUNT (MAKES CHILDS PLAY OF THIS JOB)

BY-IT-SELF ITS GREAT BUT IT WAS DESIGNED TO WORK WITH E-Z BOOKKEEPING

MACHINE LANGUAGE NIT-PICK (GREAT FOR LEARNING ASSEMBLY LANGUAGE PROGRAMING)

WORD PROCESSOR (IT WAS USED TO WRITE THIS AD)

ORDER FROM C.E.D. CORPORATION
P.O. BOX 222, SALEM, WISCONSIN 53168

PRICE LIST

	TAPE	LIST	BOTH
E-Z BOOKKEEPING	$19.95	$ 8.95	$27.95
CHECKING ACCOUNT	$ 9.95	$ 5.95	$14.95
ABOVE TWO AS A PACKAGE			$41.95
M.L. NIT-PICK	$18.95		
WORD PROCESSOR	$18.95	$ 7.95	$25.95

SPECIFY ZX80-1 OR TRS 80 COLOR COMPUTER
ZX80-1'S NEED 16K RAM
TRS 80 NEEDS 16K RAM

ALL OF OUR PROGRAMS ARE MENU DRIVEN AND ALL DATA CAN BE STORED ON TAPE AND OR SENT TO A LINE PRINTER

WE HAVE TELEPHONE SUPPORT FOR PROBLEMS OR QUESTIONS
CALL (414) 276-8787

We guarantee replacement of defective tapes

GET SMART!

Use Smartware software! We specialize in providing software for 'full-blown' Timex / Sinclair personal computers. Our programs can help you realize the full potential of your machine, for both entertainment and applications.

NEW RELEASES:

1. James Bond Adventure #1 - A unique adventure game, in which you must help 'Agent 007' make the right decisions to complete his mission. Of course, you will travel to exotic places, fight against overwhelming odds, and hopefully save the world.
2. ZX Yahtzee - The classic dice game of strategy and luck, played on a computer. For one to four players.
3. Wharri - Based on an ancient African game that was played with beans and bowls. Now you will need concentration and cunning to outwit the computer.
4. Mailing List / Phone Directory - Store the address and/or telephone number for up to 100 people. Search for entries in a variety of ways.

STANDARD FEATURES:

1. All programs will run on Sinclair ZX81 and Timex 1000 computers with 16K of RAM.
2. Software is shipped on certified error-free data cassettes, with each program recorded twice on the cassette (just in case one copy gets accidentally erased).
3. Instructions are supplied as part of each program, rather than on separate papers which tend to get misplaced.
4. Each program is available on cassette, or in listing form (if you really enjoy typing).

TO ORDER:

Send a check for $9.95 for each cassette, or $4.95 for each listing, to: Smartware, P.O. Box 1491, Melbourne, Florida 32935

Run-it Software Club

TS/1000 — Sinclair ZX-81

January Feature Program

REAL ESTATE ADVISOR

Whether you have one tenant or several buildings, Real Estate Advisor can organize the information you need to keep investments, expenses and cash flow in control, plus calculate rate of return on your investment. Real Estate Advisor also lets you do budgets, projections and shows you the results of what-if situations and calculate estimated future rates of return. It's a lot of program at a price you can easily manage. **(16K)**

Suggested Retail $16.95 **#14-10A-11**

Feature Price Good Through 1/31/83 $10.95

Additional Selections

GRAPH-IT (16K)

Graph-it plots user supplied equations as variables rather than program statements (no reprogramming necessary.) Three dimensional graphs also possible.

Sug. Ret. $16.95 **#12-4A-11**
Run-it Price: $14.95

LAB ASSISTANT (16K)

Scientific reference and teaching program includes: curve fitting of peaks and valleys, periodic table with atomic weights and numbers plus orbitals and more, molarity/normality, PPM/weight converter, metric converter.

Sug. Ret. $19.95 **#11-4B-11**
Run-it Price: $10.95

MASTERTHINK (16K)

Play against the computer and it will choose a 1 to 6 digit number then tell you which digits and positions you guess correctly. Play with another person and you choose.

Sug. Ret. $13.95 **#15-2A-11**
Run-it Price: $11.95

HIGH LEVEL MATH (16K)

Learn advanced math principles including: geometric function, circular and hyperbolic trigonometric functions, half and full incremental integration, differential equations.

Sug. Ret. $12.95 **#11-4A-11**
Run-it Price: $10.95

2K Korner

WORD PLAY **#13-2A-11**
2 games: Scramble & Cipher
Sug. Ret. $9.95 **Run-it Price: $7.95**

COMPUTER AWARENESS I **#13-8A-11**
4 programs including doing your own menu
Sug. Ret. $7.95 **Run-it Price: $6.95**

ARTIST **#13-6A-11**
Drawing graphics for floor plans, lettering, etc.
Sug. Ret. $12.95 **Run-it Price: $11.95**

MESSAGE CENTER **#13-6B-11**
Combines Artist & continuous message program
Sug. Ret. $19.95 **Run-it Price: $14.95**

HOME RECORDS **#13-6C-11**
Filing and sorting records
Sug. Ret. $13.95 **Run-it Price: $11.95**

USE THIS HANDY ORDER FORM NOW AND START RECEIVING OUR MONTHLY CATALOG.

Check your selection(s):

☐ 14-10A-11 ☐ 13-2A-11
☐ 12-4A-11 ☐ 13-8A-11
☐ 15-2A-11 ☐ 13-6A-11
☐ 11-4A-11 ☐ 13-6B-11
☐ 11-4B-11 ☐ 13-6C-11

Send to:
Run-it Software
732 S. Sherman
Chicago, IL 60605

If paying by check or money order, indicate amount enclosed.
(Ill. res. add 6%) $_____

If paying by Master Card or Visa complete the following:

Card # _____

Bank # (MC only) _____

Exp. Date _____

Signature _____

Name _____

Address _____

City _____ **State** _____ **Zip** _____

4K ROM
1K RAM

Flicker-free Four Times Normal Character Scrolling

Richard Van Workum

Programming an active display without the flicker and flash is one of the challenges confronting the ZX80 user. So far the programs published in *SYNC* with flicker free display possibilities have some limitations: 1) the program must stay in machine language; 2) all computing must be done during the vertical blacking period; or 3) everything must be timed just right. We have had lateral scrolling for one line, but this scrolling is not suitable for a billboard because it is hard to read at a distance. Another program would display a message in characters eight times their normal size, but not enough information can be displayed on the screen at one time.

A Flicker Free Message Program

The program presented here is developed from several articles in *SYNC*. As a compromise between the two extremes, it will continually scroll a flicker free message, held in the 2 REMark statement, with characters four times their normal size.

The first 45 bytes in this program store variables, lists, and tables that the program will use. The program starts at USR (16472) where it initializes the program variables in the first 45 bytes. See Figure 3.

The next part of the program creates a complete display of 24 lines. This routine is based on Dr. I. S. Logan's article "How to Produce a Display File Using Machine Code" in *SYNC* 1:2. Creating the display file starts at 16494 (see Figure 4). The routine inserts seven NEWLINE characters (118) making six blank lines. Then it makes 4 full lines of spaces to make room for the message to be scrolled. To complete the display 14 more NEWLINE characters are inserted. At the end of this routine the DF-EA, DF-END, and LINE COUNTER are set so the program can return to Basic.

The Display Routine

The display routine was based on another article by Dr. Logan, "Auto-Display-Changing" (*SYNC* 1:3) although I have made many changes. The display changers in this Horizontal Scrolling program are written in machine language so this program does not have to return to Basic. As in Dr. Logan's program most of the display routine is copied from the ZX80's 4K ROM. The display routine for the 4K ROM is listed in *SYNC* 1:3, p. 44.

The vertical blanking period starts at IN A (C) and lasts until OUT (OFFh) A. Just before the OUT instruction there is a timing loop of DJNZs. I eliminated this loop and inserted the timer-controller so now this is where the Horizontal Scrolling program does all its computing. Obviously the scrolling routines take more time than the DJNZs; however, this does not cause any problems with the vertical sync.

Each time the timer is decremented, a different subroutine is called. The subroutines are 2 REM reader, 1st quarter of expander, Nth quarter of expander, 32nd position list. One of these routines is run before the display routine continues out of vertical sync and jumps back to its beginning. If the timer has done all the needed subroutines before it reaches zero the program will cycle through the expander until the timer decrements to zero. Then it is reset to the value in 16453 and calls the display changer routine. After the changes are made, the display routine continues out of vertical blanking and jumps to its beginning.

Figure 2. Lists, Tables, and Variables.

16427	27	Holds character construction displacement (1, 3, 5, 7, 9)
16428	27	Holds graphic list displacement for expander (1, 5, 9, 13, 17)
16429	27	Graphic list
	27	
	27	
	27	
	27	
	27	
	27	
	27	
	27	
	27	
	27	
	27	
	27	
	27	
	27	
16445	27	32nd position list
	27	
	27	
	27	
16449	27	Holds displacement for 32nd position list (0, 1, 2, 3)
16450	27	Holds address of character in 2 REM to be expanded
	27	
16452	27	Holds timer countdown variable
16453	10	Holds timer constant
16454	119	Holds first address in 2 REM message
	66	Table of graphics
16456	0	
	4	
	6	
	2	
	5	
	131	
	8	
	135	
	7	
	136	
	3	
	133	
	130	
	134	
	132	
16471	128	

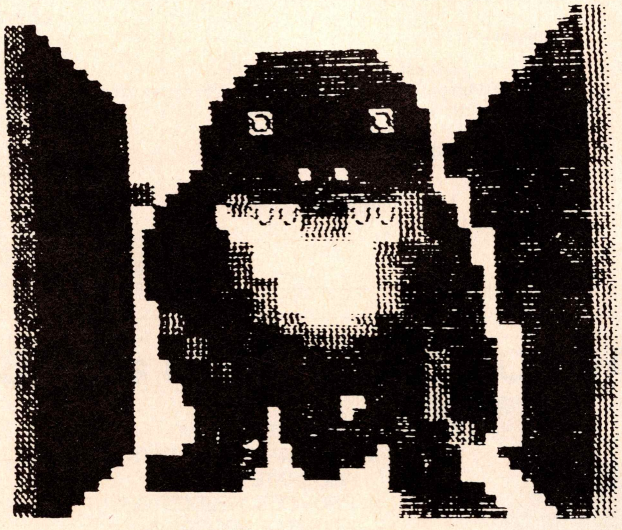
Richard Van Workum, 920 Leslie Ln., Hanford, CA 93230.

"IF I HAD TO CHOOSE JUST ONE PROGRAM TO IMPRESS AN AUDIENCE WITH THE CAPABILITIES OF THE TS1000/ZX81, THEN '3D MONSTER MAZE' WOULD BE THE ONE"*

"The Graphics Are Incredible"*

"Finest Machine Code Games Available"†

"Brilliant... Undoubtedly One Of The Best"•



3D MONSTER MAZE
Gamestape 4
Actual screen TS1000/ZX81

Reviews are from
*ZX COMPUTING
†John Rowlands, Product Manager
U.K.'s largest Sinclair distributor
•Personal Computer World

MELBOURNE HOUSE SOFTWARE INC.

Orders to:
MELBOURNE HOUSE SOFTWARE, INC.
Dept. CS
347 Reedwood Drive, Nashville, TN 37217

Visa and M/C orders can be phoned in:
615/361-3738

Dealer orders and queries:
800/251-5900
(ask for a Melbourne House operator)

		Price	Quantity	Total
13941	**Gamestape 1:** 11 Programs—1K	14.95		$
13942	**Gamestape 2:** 3 Games—16K	14.95		
13943	**Gamestape 3:** Catacombs Adventure—16K	14.95		
13944	**Gamestape 4:** 3D Monster Maze—16K	14.95		
13945	**Gamestape 5:** 3D Orbiter—16K	14.95		
PLUS BOOKS:				
26025	**NOT ONLY 30 PROGRAMS FOR THE ZX81**	14.95		
25957	**MACHINE LANGUAGE PROGRAMMING MADE SIMPLE**	19.95		
25913	**UNDERSTANDING YOUR ZX81 ROM**	19.95		
26063	**ZX81 ROM DISASSEMBLY—PART A**	14.95		
26103	**ZX81 ROM DISASSEMBLY—PART B**	14.95		
25895	**COMPLETE BASIC COURSE FOR TS1000/ZX81**	34.50		
PLUS TAPES:				
26446	**SPACE TREK** —16K	14.95		
26359	**SUPER INVASION—1K**	14.95		
26318	**WALL BUSTERS—1K**	14.95		
26472	**10 EXCITING PROGRAMS—1K**	14.95		
26284	**REVERSI—1K**	14.95		
26406	**TOOLBOX—1K**	14.95		
26490	**BASIC COURSE** 2 cassette pack	7.50		
		Total:		$
	Residents of CA, MD, TN, please add sales taxes:			
		S&H:		2.00
		Total:		$

_____Enclosed is my check or money order for $_____.
_____Please charge my Visa_____or MasterCard_____ Card #_____expiration date_____

Signature_____ Name_____

Address_____ City_____ State_____ Zip_____

SYNC

2 REMark Reader

When this subroutine is called, the next character from 2 REMark is inserted into the expander subroutine. The 2 REMark address is incremented and its contents checked for NEWLINE (118). See the flow chart. If it is not 118, then the 2 REMark address is stored in memory 16450. If it is 118, then the 2 REMark is incremented again and checked for the higher order byte of the line number for the next Basic instruction. This would signal the end of the message. Since

500 LET K=USR (16472)

is the next instruction in Basic, the high order byte is 1. If the check does not find a 1, the address is stored in memory 16450. If the check finds a 1, the address is initialized back to the first character in the 2 REMark instruction and stored in memory 16450.

Because there are several branches in this subroutine, timing loops have to be inserted. The longest branch takes place when the 2 REMark Reader is initialized back to the first character address. This branch takes 70 machine cycles. When the 2 REMark Reader just increments to the next address it only takes 12 machine cycles. A 58 cycle loop was inserted so these branches would take the same amount of time. Another 28 cycle loop was inserted for when the routine found only a NEWLINE character. A third timing loop was inserted at the end to keep the whole routing synchronized with the other subroutines. A list of machine cycles for each instruction is found in *Z80 Assembly Language Programming* by Lance A. Leventhal.

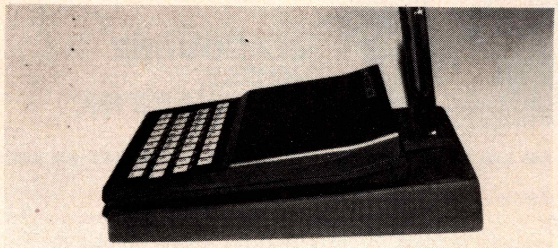
Figure 3. Initialization.

Address	Decimal		Mnemonic	Comment
16472	42, 70, 64		LD HL, (NN)	get first address in 2 REM message.
16475	34, 66, 64		LD (NN), HL	put in address of character in 2 REM to expand.
16478	33, 31, 65		LD HL, NN	load HL with start of 2 REM reader.
16481	34, 2, 65		LD (NN), HL	load controller in timer.
16484	175		XOR A	load A reg. with 0
16485	33, 61, 64		LD HL, NN	
16488	6, 5		LD B, N	
16490	119	(1)	LD (HL), A	initialize line changer displacement &
16491	35		INC HL	32nd position list to 0.
16492	16, 252		DJNZ DIS (1)	

The Expander Routine

The expander routine makes a list of graphics from the characters found in

STABILIZER PAD FOR THE ZX 80, 81 and TS 1000



- ELIMINATES SLIDING
- ELEVATES AND TILTS KEYBOARD FOR LESS FATIGUING, MORE ACCURATE TYPING
- PROVIDES NEEDED GRIP FOR 16K MODULE; PREVENTS GIGGLING & LOSS OF PROGRAM
- NEATENS WORK AREA WITH BOTTOM CAVITY FOR MANUAL, AND A CASSETTE HOLDER
- 2 YEAR WARRANTY

THIS IS A HIGH QUALITY DURABLE ELASTOMERIC PAD

$7.49 ea + $1. handling and Postage. SEND CHECK & ORDER TO:

ZOPF INDUSTRIES 121 W. Mt. Hope, Lansing, MI. 48910

SALE -ZX81 EDGE CONNECTOR $4.95 5/$23-ADD 50¢EA.
INTRODUCING:
PTX-I/O: Ø TO 16 PORT EXPANDABLE INPUT-OUTPUT PORT SYSTEM. COMMANDS IN BASIC. KEYBOARD PORT, D/A, A/D, FREQUENCY GENERATOR... USE YOUR COMPUTER TO IT'S MAXIMUM !!!
SASE GETS DETAILS
POWERTRONIX
25 E 23 ST. BAYONNE N.J. 07002 USA

16K ZX-81 SOFTWARE

FOR THE HOME:
CHECKBOOK BALANCE
ENERGY ANALYSIS
VIDEO CALC
EDUCATIONAL:
ARITHMETIC TUTOR
ALGEBRA TUTOR
SPANISH TRANSLATOR
ENTERTAINMENT:
ANIMAL QUIZ
PLAY THE MARKET
ENCRYPTOR

EACH ON A HIGH QUALITY C-10 CASSETTE @$9.95 EACH.
SEND SASE FOR PROGRAM DESCRIPTIONS

P & B SOFTWARE
1155 E. MALIBU DRIVE
TEMPE AZ 85282

Mr. Berch has it!

ZX81 Assembler
2 pass, Standard Mnemonics
Symbolic Expressions
Decimal/Hex
12K Basic & mach. code

ZX81 Disassembler
Std. mnemonics, Dec/Hex output
Assembler plus disassembler
$15 ppd (cassette)

Serial Printer interface
(thru mic port) plans & listing
RS-232 ASCII output **$5.00 ppd**
NY res. add 7%

Bob Berch
19 Jaques St.
Rochester, NY 14620

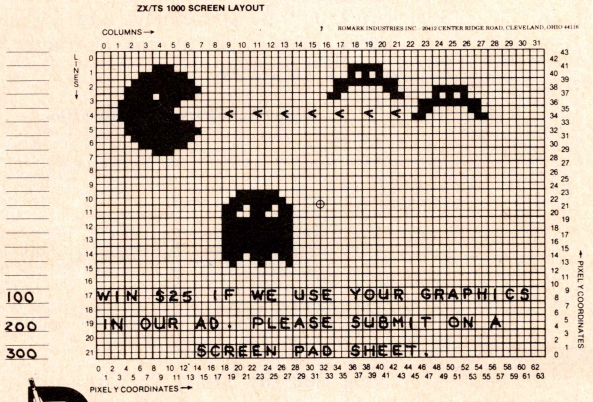
PROGRAM FASTER!

Now you can write and revise program listings faster than ever before. Never again count spaces for PRINT, PRINT AT, and PLOT functions. ROMARK SCREEN PADS are a larger, improved version of the ZX Basic Hand Book (page 89) showing line, column, and pixel numbers. We use heavy erasable paper, 50 sheets per pad..

FIVE SCREEN PADS (250 sheets)	$7.95
"LEADFOOT" SILICONE FEET 4 for	$1.50
3-RING BINDER FOR 5½x8½ SCREEN PAD SHEETS EACH	3.50
SHIPPING AND HANDLING	2.50

Send S.A.S.E. for Screen sheet sample & join our mailing list

Graphics courtesy of Alan R. Greenleaf



ROMARK INDUSTRIES, INC.
20412-30 CENTER RIDGE RD.
CLEVELAND, OHIO 44116

KEYBOARDS

IF YOU DON'T MIND DOING IT YOURSELF, YOU CAN HAVE THE MOST FUNCTIONAL, AND EASIEST TO USE KEYBOARD AVAILABLE FOR YOUR ZX81 OR TIMEX/SINCLAIR 1000. FEATURES 73 FULL SIZE KEYS WITH 46 AUTOMATICALLY SHIFTED FUNCTIONS, CONVENIENT EDITING/GAME KEYROW, AND SPECIAL GRAPHICS SECTION.

WE WILL SUPPLY THE DOUBLE SIDED PC BOARD, 3 COLOR SILKSCREENED KEY LEGENDS, PARTS LIST, AND COMPLETE INSTRUCTIONS FOR $30 OR WE WILL SUPPLY THE ENTIRE KIT FOR $80.

RESEARCH APPLICATIONS PRODUCTS
4561 Paloma Lane
Yorba Linda, CA. 92686

ALLOW 4 - 6 WEEKS FOR DELIVERY. INCLUDE $4 FOR SHIPPING AND HANDLING. CALIFORNIA RESIDENTS ADD 6 PERCENT SALES TAX. FOR ADDITIONAL INFORMATION SEND SASE.

ZKi

EDUCATION ENTERTAINMENT
Personal Management
16K Software On Cassette

ZK-PARTY GAMES $9.95
Five Games for Hours of Party Fun.
Includes Charades (500 topics), Password (500 words), Improv-Skits, Gossip, and "Radio DJ".

PARTY GAMES FOR CONSENTING ADULTS $14.95
Contains five games designed to entertain a gathering of close friends. Strip/Trivia, pits your knoweldge of trivia against your clothes. In "Body Twister" the computer tells players where to place their hands, feet, etc. on other players. Three others. Write for information.

ZK FOOTBALL $12.95
This textual version of football features 12 off. players, 8 defenses, solitaire or dual plays, auto time keeping, individually designed teams, and full team stats (including printer output). Plastic keyboard overlay.

ZK BASKETBALL RELAYS (AVAILABLE NOV. 1.)
Teams include 8 individually rated players who shoot, rebound and defend as in real life. Solitaire or two players, 1981/82 Pro (23 teams) or College Top 25. **$19.95** each.

PRIMARY ASSOCIATION $9.95
A good way to introduce your three-six year old to computers, while reinforcing school work. Provides drills for matching, association, and basic comprehension.

ARITHMETIC BASEBALL $9.95
An entertaining educational program where children and adults compete evenly while learning. Questions range from simple counting to trig. Correct answers result in hits according to relative difficulty.

HOME MANAGER $12.95
This menu driven program stores info on 50 families (enough for most) on each cassette. Names, address, phone, and four lines of miscellaneous data (up to 8 important dates). Sort on names or dates. Also includes printer output for address labels or complete files.

WE OFFER A COMPELTE LINE FOR EDUCATIONAL, GAME, HOME AND PERSONAL MANAGEMENT PROGRAMS FOR THE ZX81 AND TIMEX 1000.

CATALOG $1.00 CREDITED TOWARD FIRST ORDER.

ZOR KHAN INDUSTRIES
BOX 31567
Aurora, Colorado 80041

Full replacement warranty on all tapes. Add $1.00 postage and handling. Colorado residents add 6.5% tax. Send check, money order, or VISA-MASTER CARD Acct. #, Exp. Date, and Signature. No C.O.D. Please.

Figure 4. Making the Display File.

Address	Decimal	Mnemonic	Comment
16494	1, 117, 7	LD BC, NN	load B reg. for 6 top lines.
16497	12	INC C	load C reg. with newline.
16498	42, 12, 64	LD HL, (NN)	get start of display file.
16501	35 (1)	INC HL	point to next line.
16502	113	LD (HL), C	load line with newline.
16503	16, 252	DJNZ DIS (1)	repeat for 6 lines.
16505	6, 4	LD B, N	load B reg. for next 4 lines.
16507	197 (3)	PUSH BC	save B reg.
16508	6, 32	LD B, N	load B reg. for 32 spaces.
16510	35 (2)	INC HL	point to first space in next line.
16511	54, 128	LD (HL), N	load in inverse space.
16513	16, 251	DJNZ DIS (2)	repeat until line is full.
16515	35	INC HL	point to newline position.
16516	193	POP BC	get B reg.
16517	113	LD (HL), C	load in newline.
16518	16, 243	DJNZ DIS (3)	repeat for 4 lines.
16520	6, 14	LD B, N	load B reg. for bottom 14 lines.
16522	35 (4)	INC HL	point to next line.
16523	113	LD (HL), C	load line with newline.
16524	16, 252	DJNZ DIS (4)	repeat for 14 lines.
16526	34, 14, 64	LD (NN), HL	tell DF-EA where field ends.
16529	34, 16, 64	LD (NN), HL	tell DF-END where field ends.
16532	175	XOR A	load A reg. with 0.
16533	50, 37, 64	LD (NN), A	load line counter with 0.

Figure 5. The First Part of the Display Routine.

Address	Decimal	Mnemonic	Comment
16536	6, 1	LD B, N	load timing cycle with 1.
16538 to 16620	copy 4k rom from 321 to 403.		

the 2 REM instruction. The list of 16 graphics starts at memory address 16429 (see Figure 2). Because this routine takes so long, it was divided into four parts. Four graphics are listed each time the routine is run.

The actual construction of characters is stored in ROM starting at address 3583. To see how each character is formed multiply the code of a character by 8 and add 3583. Increment the answer and PEEK into that address. This will give the first byte of the character construction. Increment and PEEK 7 more times to get the full character. See Figure 13 below.

Figure 13. Character Construction.

CODE(8A)=38	Decimal	Binary Bit 76543210
PEEK(38*8+3583+1)	= 0	= 00000000
PEEK(38*8+3583+2)	= 62	= 00111110
PEEK(38*8+3583+3)	= 65	= 01000001
PEEK(38*8+3583+4)	= 65	= 01000001
PEEK(38*8+3583+5)	= 127	= 01111111
PEEK(38*8+3583+6)	= 65	= 01000001
PEEK(38*8+3583+7)	= 65	= 01000001
PEEK(38*8+3583+8)	= 0	= 00000000

Note that the binary 1's form an A.

The expander starts by initializing the character construction displacement and graphic list displacement to one. Then it takes the code of the character to be expanded, multiplies it times 8, adds 3583,

"CRASH GUARD"
PROTECTS YOUR ZX81 AND 16K RAM MODULE
$19.95

* Eliminates crashes caused by bumping the 16K RAM module
* Helps prevent accidental unplugging of your 16K by small children
* Now you can move your computer without worry

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

Please send me _____ CRASH GUARDS© $19.95 each

☐ Check Enclosed
☐ Master Card
☐ Visa

Acct. No. _____

Exp. Date _____

Allow 2 weeks for delivery

EXPENSE CUTTER PRODUCTS, INC.
P.O. BOX 9543 • RAYTOWN, MO. 64133

The CRASH GUARD is made of Heavy Gauge Bronze-Colored Acrylic. It has been designed to give you a rugged work base. At the same time, it virtually eliminates crashes caused by bumping the computer or 16K module.

To order by phone, call (816) 353-1690

LOVE AT FIRST BYTE

C-20 Magazine has something for every TS-1000 or ZX-81 owner to love each month. We offer 2K and 16K programs in each issue.

Educational Software
Software for your Home
Games Games Games
Editorial Section
The C-20 Mailbox
Classified Ads

A Big Time-Saving Value. Less than $4.20 per issue with over 75 programs per year. That's less than 66 cents per program!

C-20 Magazine

Big Savings if you order Now!

1 Year (12 issues)	$49.95
after Dec. 25	59.95
6 Months (6 issues)	34.95
after Dec. 25	38.95

Kansas residents add 3%. First class mail included in North America. All others add $10 per subscription.

24 Hr. Toll Free Order Line
1-800-835-2246 Ext. 240
or in Kansas
1-800-362-2421 Ext. 240
VISA and MasterCard

P.O. Box 3801
Wichita, Ks. 67201-3801

515 N. Ridge Road / Suite B
Wichita, Ks. 67212

PRINTER INTERFACE

CENTRONICS STYLE PARALLEL PORT PRINTER INTERFACE ENABLES USER TO PRINT ALPHANUMERICS, AND SELECTED GRAPHICS SYMBOLS USING THE 8K-16K ZX-80,ZX-81, OR THE TIMEX 1000 WITH THE AXIOM GP-100A PRINTER.

(Also compatible with other Centronics Standard printers.)

PRINTER COMMANDS AND M/L PROGRAMS ARE STORED IN AN 8K MEMORY AREA NOT USED BY COMPUTER.PROGRAMS ALLOW PRINTOUT OF LISTINGS,SCREEN DISPLAYS, M/L CODE, TEXT--32 COLUMNS FOR LABELS, WIDE LETTERS,ETC., OR 63 COLUMNS WIDE FOR LETTER-SIZE PAPER.

CASSETTE PROGRAMS,I/O BOARD (SEE LEFT),**EXTRA 8K ROM BOARD WITH 2K ROM AND 2K CMOS RAM**, AND WITH COMPLETE INSTRUCTIONS----------$135

SPECIAL BASIC PROGRAMS CAN BE STORED IN 2K CMOS RAM FOR INSTANT RECALL.

CUSTOM PROGRAMMED 2K ROMS----------$15

I/O BOARD

PROGRAMMABLE 8255 PIO BOARD FOR MICRODACE,ZX-80,ZX-81 OR TIMEX 1000 (8K-16K) CAN BE USED WITH ONE INPUT PORT AND TWO OUTPUT PORTS,OR THREE OUTPUT PORTS. EACH LINE CAN BE TURNED ON OR OFF ON ONE OUTPUT PORT.

FOUR OUTPUT LINES PROGRAMMABLE WITH 1US. PULSES.

RESET LINE BROUGHT OUT ON I/O BOARD.

OTHER UNITS CAN BE PLUGGED IN TO I/O BOARD (EXTRA +5 VOLT POWER MAY BE REQUIRED)

I/O BOARD WITH PROGRAMS AND INSTRUCTIONS----- $45

PROFESSIONAL ELECTRONICS

109 CHESNEY LANE COLUMBIA,S.C. 29209

Figure 6. Timer/Controller.

Address	Decimal		Mnemonic	Comment
16621	58, 68, 64		LD A, (NN)	get countdown from 16452.
16624	61		DEC A	decrement countdown.
16625	32, 11		JR NZ, DIS (1)	jump if not zero.
16627	58, 69, 64		LD A, (NN)	get timer constant.
16630	50, 68, 64		LD (NN), A	reset countdown.
16633	205, 254, 65		CALL NN	call line changer.
16636	24, 6		JR DIS	jump to second part of display routine.
16638	50, 68, 64	(1)	LD (NN), A	load decremented value into countdown.
16641	205, 0, 0		CALL NN	call subroutine that was loaded from previous subroutine.

Figure 7. The Second Part of the Display Routine.

Address	Decimal	Mnemonic	Comment
16644 to 16664	copy 4k rom from 406 to 426.		
16665	205, 173, 1	CALL NN	call show.
16668	195, 152, 64	JP NN	jump to first part of display.

Figure 9. Expander, Part A (1st quarter).

Address	Decimal	Mnemonic	Comment
16725	33, 1, 1	LD HL, NN	initialize graphic list displacement & character construction displacement to 1. (38 cycles)
16728	34, 43, 64	LD (NN), HL	
16731	24, 5	JR DIS (1)	jump over 38 clock cycle timer.

Figure 10. Expander, Part B (Nth quarter).

Address	Decimal		Mnemonic	Comment
16733	6, 2		LD B, N	load timer. (38 cycles)
16735	200	(2)	RET Z	run timer.
16736	16, 253		DJNZ DIS (2)	
16738	237, 75, 43, 64	(1)	LD BC, (NN)	get character construction dis. into C reg.
16742	6, 0		LD B, N	set B reg. to 0.
16744	33, 0, 0		LD HL, NN	load HL with code of character to expand.
16747	41		ADD HL, HL	multiply times 8.
16748	41		ADD HL, HL	
16749	41		ADD HL, HL	
16750	17, 255, 13		LD DE, NN	load DE with start of character const. list,3583.
16753	25		ADD HL, DE	point to first byte in list.
16754	9		ADD HL, BC	
16755	17, 0, 0		LD DE, NN	clear DE.
16758	78		LD C, (HL)	load C reg. with first byte.
16759	35		INC HL	point to second byte.
16760	70		LD B, (HL)	load B reg. with second byte.
16761	62, 128		LD A, N	load A to check bit 7.
16763	87	(x)	LD D, A	save in D reg.
16764	161		AND C	check bit n of first byte.
16765	40, 6		JR Z, DIS (3)	if no graphic table dis. then jump to timer.
16767	62, 1		LD A, N	load A with a displacement of 1.
16769	131		ADD A, E	total displacement.
16770	95		LD E, A	save total in E reg.
16771	24, 6		JR DIS (4)	jump over timer.
16773	62, 1	(3)	LD A, N	22 cycle timer.
16775	61		DEC A	
16776	0		NOP	
16777	32, 254		JR NZ, DIS	
16779	122	(4)	LD A, D	load A to check bit n.
16780	160		AND B	check bit n of second byte.
16781	40, 6		JR Z, DIS (5)	if no graphic table dis. then jump to timer.
16783	62, 2		LD A, N	load A with a displacement of 2.
16785	131		ADD A, E	total displacement.
16786	95		LD E, A	save total in E reg.
16787	24, 6		JR DIS (6)	jump over timer.
16789	62, 1	(5)	LD A, N	22 cycle timer.
16791	61		DEC A	
16792	0		NOP	
16793	32, 254		JR NZ, DIS	
16795	122	(6)	LD A, D	load A for ckecking bit n.

VERIFY

A SOFTWARE ALTERNATIVE TO HARDWARE MONITORS

A Machine Code Program designed to **VERIFY** that the program you thought you saved is reloadable without having to clear the memory by reloading **EITHER** embed **VERIFY** into important programs **OR** use as a programming aid

DOCUMENTATION INCLUDES

- Full instructions for implementation
- Program listing $3.00
- Cassette $5.00
- 16k required

WI residents add sales tax

SPACE BREAKER
P.O. Box 8104
Green Bay, WI
54308

```
16796   203, 15        RRC A           load A to check bit n-1.
16798   87             LD D, A         save in D reg.
16799   161            AND C           check bit n-1 of first byte.
16800   40, 6          JR Z, DIS (7)   if no graphic table dis. then jump to timer.
16802   62, 4          LD A, N         load A with a displacement of 4.
16804   131            ADD A, E        total displacement.
16805   95             LD E, A         save total in E reg.
16806   24, 6          JR DIS (8)      jump over timer.
16808   62, 1    (7)   LD A, N
16810   61             DEC A           22 cycle timer.
16811   0              NOP
16812   32, 254        JR Z, DIS
16814   122      (8)   LD A, D         load A to check bit n-1.
16815   160            AND B           check bit n-1 of second byte.
16816   40, 6          JR Z, DIS (9)   if no graphic table dis. then jump to timer.
16818   62, 8          LD A, N         load A with a displacement of 8.
16820   131            ADD A, E        total displacement.
16821   95             LD E, A         save total in E reg.
16822   24, 6          JR DIS (10)     jump over timer.
16824   62, 1    (9)   LD A, N
16826   61             DEC A           22 cycle timer.
16827   0              NOP
16828   32, 254        JR Z, DIS
16830   122     (10)   LD A, D         save D reg. in A reg.
16831   22, 0          LD D, N         set D reg. to 0.
16833   33, 72, 64     LD HL, NN       point to start of table.
16836   25             ADD HL, DE      add displacement.
16837   94             LD E, (HL)      load graphic code into E reg.
16838   87             LD D, A         restore D reg.
16839   58, 44, 64     LD A, (NN)      get graphic list dis.
16842   50, 211, 65    LD (NN), A      put dis. into (IX+d).
16845   221, 33,
        44, 64         LD IX, NN       load IX reg. with start of graphic list -1.
16849   221, 115, 0    LD (IX+d), E    load graphic list with graphic code.
16852   60             INC A           increment displacement.
16853   50, 44, 64     LD (NN), A      save new displacement.
16856   30, 0          LD E, N         set table displacement counter to 0.
16858   122            LD A, D         get bit checker.
16859   203, 15        RRC A           rotate for next bit.
16861   48, 156        JR NC, DIS (X)  if all bits have not been checked then do again.
16863   58, 43, 64     LD A, (NN)      get character construction displacement.
16866   60             INC A           increment dis.
16867   60             INC A           increment dis.
16868   50, 43, 64     LD (NN), A      save new dis.
16871   254, 9         CP N            check if all bytes of character have been used.
16873   40, 6          JR Z, DIS (11)  if yes jump to run expander again.
16875   0              NOP             use 4 clock cycles.
16876   33, 93, 65     LD HL, NN       load HL with part B of expander.
16879   24, 5          JR DIS (12)     jump to load caller.
16881   33, 85, 65 (11) LD HL, NN      load HL with part A of expander.
16884   24, 0          JR DIS (12)     use 12 clock cycles.
16886   34, 2, 65 (12) LD (NN), HL     load caller.
16889   6, 100         LD B, N         load time delay loop.
16891   16, 254  (13)  DJNZ DIS (13)   run delay loop.
16893   201            RET             return to caller.
```

Figure 11. Display Changer.

Address	Decimal		Mnemonic	Comment
16894	221, 33, 60, 64		LD IX, NN	point to start of 32nd position list -1.
16898	42, 12, 64		LD HL, (NN)	point to start of display file.
16901	17, 8, 0		LD DE, NN	load displacement for display file.
16904	25		ADD HL, DE	point to first character in 7th line.
16905	62, 4		LD A, N	set A for 4 lines.
16907	84	(1)	LD D, H	load DE with HL for LDIR instruction's
16908	93		LD E, L	destination
16909	35		INC HL	load HL for LDIR instruction's source.
16910	1, 31, 0		LD BC, NN	load BC for list of 31.
16913	237, 176		LDIR	rotate line.
16915	50, 24, 66		LD (NN), A	load displacement in (IX+d).
16918	221, 126, 0		LD A, (IX+d)	get graphic for 32nd position.
16921	18		LD (DE), A	load 32nd position.
16922	58, 24, 66		LD A, (NN)	get back displacement/line count.
16925	61		DEC A	decrement line count.
16926	40, 3		JR Z, DIS (2)	if 0 then all 4 lines have been rotated.
16928	35		INC HL	point to first position of next line.
16929	24, 232		JR DIS (1)	go rotate next line.
16931	33, 42, 66	(2)	LD HL, NN	load HL with start of 32nd position list routine.
16934	34, 2, 65		LD (NN), HL	load controller to make new list.
16937	201		RET	return to caller.

Now Sinclair computer owners can have real personal security for communications, information, data, with the advanced capability of

CYPHER9 (16K)

■ Menu-driven, touch-controlled, encode/decode/change/ scramble/ unscramble/save message/saveall

■ Convenient operation requires no knowledge of programming, or previous experience with codes

Have the security of unbreakable codes** with CYPHER9 from ROBILL Send $39.95 check or money order to ROBILL PRODUCTS 555 Park Avenue, Paterson, NJ 07504 NJresadd5%

**Random trial decoding requires $>10^{90}$ years/code; $>10^{100}$ codes Conditions of key number protection prevent security guarantee Also see our advertisement for MX-PAC in this issue

SERIOUS PROGRAMMERS

"MUST-HAVE" UTILITIES
For ZX-81 and T/S 1000 Computers

■ READ/WRITE Cassette Data Files
($10) Fast • Flexible • Error checking
Works in 2K RAM

■ SAVE/MERGE/ERASE BASIC
($15) Powerful editing tool
Merge BASIC programs
Save BASIC program on data file
Erase blocks of BASIC
Use in 16-64K RAM
(Includes read/write data files)

Simple user interface via USR function
Well-documented user manuals
Available on tape cassette in relocatable machine language

SASE for info — Check or MO delivers now

SiriusWare
6 Turning Mill Road
Lexington, MA 02173

ZX-80 8K ROM USERS

Completely expand your ZX-80 with 8K Rom to a ZX-81 with full use of *Fast* and *Slow*. Smooth flicker free performance!

Complete Kit: $32.50 & $2.50 postage & handling; PCB only $19.95 & $1.25 p&h; Parts Kit Only $12.55 & $1.25 p&h.

The Expandable ZX-80 and ZX-81
A book of hardware projects that you can build yourself, from memory expansion to speech synthesis. Only $9.95 & $1.25 p&h.

Program writers: We publish software and complete books. Write for details.

COMPUTER ENGINEERING SERVICES
The Jarrett Company
P.O. BOX 1222
SHOW LOW, ARIZONA 85901

(Dealers Inquiries Invited)

Figure 8. 2 REMark Reader.

Address	Decimal		Mnemonic	Comment
16671	42, 66, 64		LD HL, (NN)	get adderss of character to expand.
16674	126		LD A, (HL)	load character into A reg.
16675	50, 105, 65		LD (NN), A	load character into expander. (16745).
16678	35		INC HL	point to next character.
16679	78		LD C, (HL)	load character into c reg.
16680	62, 117		LD A, N	load a reg. with newline.
16682	60		INC A	
16683	185		CP C	check next character for newline.
16684	32, 12		JR NZ, DIS (1)	jump to timing loop if not zero.
16686	35		INC HL	point to next character.
16687	78		LD C, (HL)	load character into c reg.
16688	62, 1		LD A, N	load a reg. with high order byte of next Basic instruction.
16690	185		CP C	check for end of message.
16691	32, 14		JR NZ, DIS (2)	jump to timing loop if not zero.
16693	42, 70, 64		LD HL, (NN)	get address of first character in 2 REM.
16696	24, 13		JR DIS (3)	jump to reset 2 REM reader.
16698	62, 2	(1)	LD A, N	
16700	0		NOP	
16701	0	(4)	NOP	58 clock cycle timing loop.
16702	61		DEC A	
16703	32, 252		JR NZ, DIS (4)	
16705	24, 4		JR DIS (3)	
16707	1, 2	(2)	LD B, N	28 clock cycle timing loop.
16709	16, 254	(5)	DJNZ DIS (5)	
16711	34, 66, 64	(3)	LD (NN), HL	load address of next character to expand.
16714	33, 85, 65		LD HL, NN	load HL with start of expander.
16717	34, 2, 65		LD (NN), HL	load controller with start of expander.
16720	6, 192		LD B, N	load time delay loop.
16722	16, 254	(6)	DJNZ DIS (6)	run delay loop.
16724	201		RET	return to caller.

Clock Cycles Required If:

2 REM reader is reset	newline only found	newline not fnd.
7	7	12
6	6	
7	7	
7	7	
4	4	
7	12	
20		
12		
		7
		4
		4/4
		4/4
		12/7
		12
	7	
	13/8	
70	71	70

Totals for each branch have to be approximately the same.

and adds the character construction displacement. It then gets the first and second byte that forms the character and checks bit 7 of the first byte for a 1 by ANDing the byte with 128d, or 10000000b, and comparing the result with 128d. If there is a 1, a displacement counter for the graphics table is loaded with a displacement of one. Then the program ANDs the second byte with 128d to check bit 7 for 1. If a 1 is found, a displacement of 2 is added to the table displacement counter. Then bit 6 of the first byte is checked by ANDing with 64d or 1000000b and comparing the result with 64d. If a 1 is found, 4 is added to the displacement counter. Then bit 6 of the second byte is checked. If a 1 is

M.C. LOTHLORIEN

A FANTASTIC RANGE OF **16K** WARGAMES FOR THE EACH COMPLETE WITH COMPREHENSIVE INSTRUCTIONS.

ZX81

SPECIAL CHRISTMAS OFFERS SAVE UP TO $20!
Separate games $14 (each); Buy 3 for $35, or all 5 for a fantastic $50

1. TYRANT OF ATHENS.
Can you survive long enough to turn Athens into the most feared state in the Mediterranean? Train troops, build warships, fight battles by land and sea against hostile Greek States and the vast Persian Empire. Many more features in this very addictive game.

2. ROMAN EMPIRE.
Your aim is to conquer the hostile countries surrounding Rome. Build armies, appoint Generals and fight campaigns. This challenging game takes full account of morale, fighting efficiencies, leadership ability, etc. **3 levels of play**. Playing time 2 hours - 2 days!

3. PELOPONNESIAN WAR.
Set in Ancient Greece from 431-404 BC, covering the Great War between Athens and Sparta. Your goal is a final victory over the Spartans but you will need all your skill in a combination of diplomacy and military force before you even stand a chance. **3 levels of play**.

4. SAMURAI WARRIOR.
How could you have fared as a Samurai in the 13th Century Japan? Face challenges from other Samurai and bandits. Are you a survivor? Or will you be forced to commit ritual suicide? **7 levels of play**.

5. WARLORD.
A challenging game of analytical skill. You are a warlord in 13th Century Japan. You have to defeat attacks by other warlords and pirates, capture slaves and clothe and feed your troops. A companion game to Samurai Warrior.

ALL PRICES INCLUDE FULL POST AND PACKING.
CHEQUES OR INTERNATIONAL MONEY ORDERS PLEASE, PAYABLE TO

M.C. LOTHLORIEN, 4 Granby Road, Cheadle Hulm, Cheshire, SK8 6LS U.K.

ZX81 - TS1000

SOFTWARE

DR. FLOYD

Psychoanalysis by computer? - well, not quite but Dr. Floyd will carry on a conversation with you using psychoanalytic techniques giving the appearance of artificial intelligence. Requires 16K RAM. $10.95

GRAPHICS PAC I

An introduction to Sinclair graphics-includes: 2 random picture drawers, allow creation of "Pop" art. A screen formatter which allows placing any character anywhere on the screen. Complex pictures may be created & saved. Doodler allows line art drawings to be created & saved. Requires 16K. $10.95

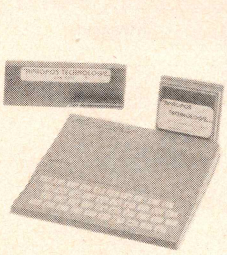
WORD PLAY

Includes: "Jargon" - a jargon word generator. "Animal" - a fun game where the player teaches the computer all about animals. "Story" - the computer writes stories using the players input names, places, etc. Can be very funny for kids. "Haiku" - the computer composes HAIKU like poetry. Requires 16K. $10.95

SNAKES ALIVE

A group of arcade type snake games. You must evade, box in, capture or destroy. Fast moving and a lot of fun. Requires 16K. $12.95

All software is on high quality cassettes and is replacement guaranteed.



TO ORDER:

Send Check or Money Order
For the total plus:
$3.00 shipping (Software)
or $4.00 shipping (Hardware)
Calif. residents add 6% tax.
Phone orders: CALL
805/482-3604

master charge VISA

For credit card orders, include all information on card.

HARDWARE

$45.95 SIN16 16K RAM

This RAM plug-in allows the user to run virtually all programs written for the ZX81 or TS1000. Completely assembled & tested. The reliable one.

$135.95 SUPER SIN64 64K RAM

This is the maximum directly addressable RAM that your ZX81 or TS1000 can use - Memory is used as follows: 0-8K Sinclair operating ROM. 8-16K switches in or out of use. Used for assembly language routines, memory mapped peripherals. Contents are safe from NEW and cassette (disc) loads thus allowing program-to-program communications. 16-32K BASIC and assembly language user program area. 32-64K large data arrays & BASIC variables.

All hardware is completely compatable with Sinclair add-on products. Both RAMS use the most reliable gold plated, bifurcated contact connector on the market.

10 day return privilege on all hardware-90 day parts and labor warranty-inexpensive extended service contract is available-
WE SERVICE WHAT WE SELL.

APROPOS TECHNOLOGY

350 N. Lantana Ave., Suite 821 • Camarillo, CA 93010

Ephemeris V

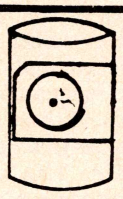
PLANET FINDER FOR THE 16K TS-1000/ZX-81

MERCURY, VENUS, MARS, JUPITER and SATURN are all visible to the naked eye. The ancients recognized that their special quality is that they move against the background of "fixed" stars. Predicting their movements has been the preoccupation of geniuses for thousands of years. Now these movements are well understood, buy only by a few dedicated observers. Ephemeris V is designed for these people and others (ages 12 and up) who wish to join them in this pursuit of basic knowledge. 16K reqd.

ENTER: date, time, lat. and long. (Lat. and long. can be perm.) Then choose a planet. In seconds Ephemeris V responds with:

1. **Azimuth and Altitude**
2. **Right Ascension and Declination (for astronomers)**
3. **Simple compass coordinates (for beginners)**
4. **GRAPHIC DISPLAY of planet in current constellation**
5. **LOCAL sidereal (star) time to aid in finding stars, comets, nebulas, etc.**

Own or give this incredible program and reap the harvest of real understanding forever! Comes on quality cassette with documentation. Send a money order or check for $8.00 ppd. to: EPHEMERIS V, P.O. BOX 261, Winchester, KY 40391.



GENERAL SYSTEMS CONSULTING
2312 Rolling Rock Drive
Conley, Georgia 30027
SINCLAIR ZX81 and
TIMEX SINCLAIR 1000 SOFTWARE
16K minimum configuration
Designed to help monitor your finances.

1. Amortizations	9.95
2. Bar Charts	9.95
3. Annuity Evaluation	9.95
4. File Manager	9.95
5. Bank Statement Balancer	9.95
6. Checkbook Simulator	9.95
7. Depreciation Straight Line	9.95
8. Depreciation Declining Balance	9.95
9. Depreciation (ACRS)	9.95
10. Diet Plan	9.95
11. Home Budget	9.95
12. Home Inventory	9.95
13. Home Payables	9.95
14. Home Equity Evaluation	9.95
15. Real Estate Investing	9.95
16. Savings/Investments Analysis	9.95
17. IRS 1040 (Long Form)	9.95
18. IRS 1040A (Short Form)	9.95
19. Income Tax Projections	9.95

Circle selections and fill out form below:
1 2 3 4 5 6 7 8 9 10
11 12 13 14 15 16 17 18 19

Number of items selected ____ @ 9.95 ____
Postage/Handling 1.50 ____
Total: ____

NAME _____
ADDRESS _____
CITY/STATE/ZIP _____

MUSICIANS!

Music theory & ear training program cassettes for TIMEX/SINCLAIR Computers (minimum 2K RAM). $5.95 for sample or send SASE for catalog of programs.

EVANSOFT - Dept. M
1246 Elmwood Avenue
Evanston, IL 60202

***** for TIMEX/SINCLAIR computers *****

LOST IN SPACE (uses SLOW) 11.95
UNIVERSAL INVENTORY FILE 16.95
UNIVERSAL MAILING LIST 10.95
UNIVERSAL COIN COLLECTION 10.95
UNIVERSAL STAMP COLLECTION 10.95
UNIVERSAL COMIC BOOK COLLECT 10.95
UNIVERSAL BASEBALL CARD COLL 10.95
UNIVERSAL RECORD ALBUM COLL 10.95

Each program on cassette + manual. (8K ROM, 16K RAM). Please add $1.50 for shipping and handling. N.J. residents add 5% tax.

M.C. HOFFMAN CO.
P.O. BOX 117, OAKLAND, N.J. 07436

HOME CLOCK FAMILY BULLETINS
TIMEX SINCLAIR 1000/SINCLAIR ZX81 16K
Continuously running clock calendar and family bulletins. User friendly allowing selection of over 12 functions. Menu driven, large clock digits, set date/time/alarm, update bulletins, fully doc. Send $20 for program or SASE for brochure to:
KING SOFTWARE
85 Myrtle St., Lowell, MA 01850

COMPUTER / VIDEO GAME
REPAIR
AID ELECTRONICS
9711 S. Petersham Dr.
Houston, Tx. 77031

16-32-48K expanda RAM
$45-65-85 fits inside
(outside add $8) list with a SASE

Dancer
9850 Metro Parkway West, suite 100
Phoenix AZ 85021

For ZX81 & TS1000 16K RAM
NEW DOMINO Game
challenging and exciting
Other New Games Available
send SASE for FREE info:
PHOTOLAB
P.O. Box 21124
Kennedy Space Center, FL. 32815
$9.95 on cassette

Need a good game to play or program? Circle Chess board with instructions $5.00. Send your recorded Circle Chess games and programs for publication in Circle Chess Journal, Box 63, Des Plaines, IL 60017.

Figure 12. 32nd List Routine.

```
Address  Decimal              Mnemonic          Comment
16938    17, 64, 64          LD DE, NN         point to bottom of 32nd position list.
16941    221, 33, 45, 64     LD IX, NN         point to top of graphic list.
16945    58, 65, 64          LD A, (NN)        get displacement for 32nd position list.
16948    6, 4                LD B, N           set B reg. for 4 graphics.
16950    79            (1)   LD C, A           save displacement in C reg.
16951    50, 60, 66          LD (NN), A        load displacement in (IX+d).
16954    221, 126, 0         LD A, (IX+d)      get graphic from graphic list.
16957    18                  LD (DE), A        load in 32nd position list.
16958    27                  DEC DE            point to next position.
16959    121                 LD A, C           put displacement into A reg.
16960    198, 4              ADD A, N           add 4
16962    16, 242             DJNZ DIS (1)      go do next graphic.
16964    58, 65, 64          LD A, (NN)        get displacement for 32nd position list.
16967    254, 3              CP N              check if 16 graphics have been used.
16969    40, 10              JR Z, DIS (2)     if yes then initialize.
16971    0                   NOP               use 4 clock cycles.
16972    60                  INC A             increment displacement.
16973    50, 65, 64          LD (NN), A        store displacement.
16976    33, 85, 65          LD HL, NN         load HL with start of part A of expander.
16979    24, 9               JR DIS (3)        jump to load controller.
16981    175           (2)   XOR A             load A reg. to initialize displacement.
16982    50, 65, 64          LD (NN), A        store displacement.
16985    33, 31, 65          LD HL, NN         load HL with start of 2 REM reader.
16988    24, 0               JR DIS (3)        use 12 clock cycles.
16990    34, 2, 65     (3)   LD (NN), HL       load controller.
16993    6, 190              LD B, N           load time delay
16995    16, 254       (4)   DJNZ DIS (4)      run time delay.
16997    201                 RET               return to caller.
```

found, 8 is added to the table displacement counter. If 1 is in all four bits, the table displacement counter contains 1 + 2 + 4 + 8 = 15. The table starts at 16456 so 16456 + 15 = 16471 (see Figure 2). This address contains 128d or the CODE for inverse space. This graphic represents the four bits in the first two bytes of the character being expanded. The expander loops until all the bits are checked and four graphics are listed. The remaining bytes are decoded during the next three times the expander is run.

Now it is time to get ready to display again. The character construction displacement and graphic list displacement are saved and the controller is set so the routine will not initialize until after the expander computes the graphics for the six remaining bytes.

This expander routine contains timing loops as in the 2 REMark reader. There is one that is just as long as the initialization so that the last three runs are times as long as the first run. There are loops so that finding a 0 takes just as long as finding a 1. If these loops were not included, each character being expanded would take a different amount of time to decode. Finally, there is a loop at the end to keep this routine synchronized with the other routines.

The Display Changer

All the other routines are preliminaries that take place during several vertical blanking periods. The display for the Horizontal Scrolling program has to be changed during one vertical blanking period to get a complete display.

The display changer rotates the character in line 7 one space to the left with the Z80 LDIR instruction. The first character before rotation is eliminated. After rotation, the 32 position is filled with a graphic character from the "32nd Position List" which starts at 16445 (see Figure 12). The routine loops until the next three lines are rotated and their 32nd positions filled with their graphics. Next the controller is set to the routine that computes a new list of graphics for the 32nd positions.

There are no timing loops because this subroutine takes a longer time to run than any other subroutine. The display changer takes just as long to run each time it is run.

The 32nd Position List Routine

This part of the program (see Figure 12) was written to make the display changer run more efficiently since it takes the longest time to run. The graphics in the 16 graphic expander list are not in order to fill the 32nd line positions so another list of four graphics is made.

After a new character from 2 REM is expanded, the 1st, 5th, 9th, and 13th graphics are listed in the 32nd position list. A displacement for the expander list is incremented and stored in memory 16449 (see Figure 2). The controller is set for the expander and after another timing loop, the program goes back to finish the display cycle. The program will cycle through the expander and display until the timer runs to zero and the display changer uses the graphics in the 32nd position list. The controller is then

set for the 32nd position list routine.

After displaying again, the controller runs this subroutine again. The displacement is taken from 16449 so that the 2nd, 6th, 10th, 14th graphics are listed. The cycle repeats until all 16 graphics are used. Then the displacement is reset and the controller is set to run the 2 REM reader to get a new character.

Loading the Program

Since the loading for this program was designed for 1K RAM, the procedure was broken up into several parts. This makes loading somewhat difficult. So following the directions carefully is essential.

Constructing the 1 REM Statement

Make a 1 REMark statement that is exactly 6 lines long as shown.

```
  1 REM .....
.....
.....
.....
.....
.....
.....
```

Duplicate the 1 REM statement to make the 2 REM statement by pressing EDIT, RUBOUT, 2 and NEWLINE. Two REM statements now appear on the screen. Add a third REM statement in the same way by pressing EDIT, RUBOUT, 3, and NEWLINE. Now only the 3 REM statement is on the screen.

We will now combine these three statements into one REM statement by removing the end-of-line character 118 at the end of each of the first two REM statements. Enter these instructions in the immediate mode (i.e., without line numbers):

```
POKE 16619,0
POKE 16815,0
```

The one long REM statement which results is scrolled off the screen so the screen is now blank.

Entering the Loader Program

Next, enter the loader program in Figure 1.

Figure 1. Loader Program.

```
  2 FOR I=16453 TO 16537
  3 INPUT A
  4 IF PEEK(16421)=20 AND PEEK(
16420)=1 THEN CLS
  5 PRINT CHR$((A<10)+1);CHR$((
A<100)+1);A;"#";
  6 POKE I,A
  7 LET B=B+A
  8 NEXT I
```

This program must be kept short because the 1 REM statement is so long and bytes have to be saved for displaying the data we are about to enter.

The B variable is used as a checksum. We must initialize B before using the loader program. Enter the following instruction in the immediate mode:

```
LET B=0
```

In order to save B do not use RUN. Instead, enter in the immediate mode this instruction:

```
GO TO 2
```

Entering the Machine Code

We are now ready to enter the program that we have been developing since Figure 2. Enter the following numbers as they will appear on the screen four lines at a time to make checking easier. (The list starts at 16453 in Figure 2.)

```
 10 119  66   0   4   6   2   5
131   8 135   7 136   3 133 130
134 132 128  42  70  64  34  66
 64  33  31  65  34   2  65 175
-----------------------------------
 33  61  64   6   5 119  35  16
252   1 117   7  12  42  12  64
 35 113  16 252   6   4 197   6
 32  35  54 128  16 251  35 193
-----------------------------------
113  16 243   6  14  35 113  16
252  34  14  64  34  16  64 175
 50  37  64   6   1
```

Change line 2 of Figure 1 to:

```
2 FOR I=16621 TO 16643
```

Enter the following immediate instruction:

```
GO TO 2
```

and type in the following numbers:

```
 58  68  64  61  32  11  58  69
 64  50  68  64 205 254  65  24
  6  50  68  64 205   0   0
```

Change line 2 of the Figure 1 to:

```
2 FOR I=16665 to 16997
```

Enter the immediate instruction:

```
GO TO 2
```

and type in the following numbers:

```
205 173   1 195 152  64  42  66
 64 126  50 105  65  35  78  62
117  60 185  32  12  35  78  62
  1 185  32  14  42  70  64  24
-----------------------------------
 13  62   2   0   0  61  32 252
 24   4   1   2  16 254  34  66
 64  33  85  65  34   2  65   6
192  16 254 201  33   1   1  34
-----------------------------------
 43  64  24   5   6   2 200  16
253 237  75  43  64   6   0  33
  0   0  41  41  41  17 255  13
 25  17   0   0   9  78  35  70
-----------------------------------
 62 128  87 161  40   6  62   1
131  95  24   6  62   1  61   0
 32 254 122 160  40   6  62   2
131  95  24   6  62   1  61   0
-----------------------------------
 32 254 122 203  15  87 161  40
  6  62   4 131  95  24   6  62
  1  61   0  32 254 122 160  40
  6  62   8 131  95  24   6  62
-----------------------------------
  1  61   0  32 254 122  22   0
 33  72  64  25  94  87  58  44
 64  50 211  65 221  33  44  64
221 115   0  60  50  44  64  30
-----------------------------------
  0 122 203  15  48 156  58  43
 64  60  60  50  43  64 254   9
 40   6   0  33  93  65  24   5
 33  85  65  24   0  34   2  65
-----------------------------------
  6 100  16 254 201 221  33  60
 64  42  12  64  17   8   0  25
 62   4  84  93  35   1  31   0
237 176  50  24  66 221 126   0
-----------------------------------
 18  58  24  66  61  40   3  35
 24 232  33  42  66  34   2  65
201  17  64  64 221  33  45  64
 58  65  64   6   4  79  50  60
-----------------------------------
 66 221 126   0  18  27 121 198
  4  16 242  58  65  64 254   3
 40  10   0  60  50  65  64  33
 85  65  24   9 175  50  65  64
-----------------------------------
 33  31  65  24   0  34   2  65
  6 190  16 254 201
```

Using the Checksum Routine

Enter the immediate instruction:

```
PRINT B
```

and 29321 should appear on the screen. If it does not, you will have to go back and reenter the numbers.

Processing the Machine Code

Erase lines 2-7 by typing in each line number and NEWLINE.

Enter the following program:

```
2 FOR I=16538 TO 16620
3 POKE I, PEEK (I-16217)
8 NEXT I
```

RUN this program (you may now use RUN).

Change the above program so that will read:

```
2 FOR I=16644 TO 16664
3 POKE I, PEEK (I-16238)
8 NEXT I
```

RUN this program.

Entering Your Message

Prepare a 1 REM statement with the message you want to rotate and enter it with the following program. For example,

```
2 REM "SYNC" THE
  MAGAZINE
FOR SINCLAIR USERS.
500 LET K=USR (16472)
```

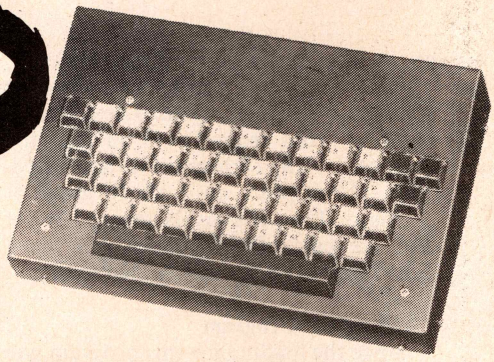
Be sure to use 500 for the USR line because the program uses it for a flag to signal the end of the message. RUN the program and your message will continually scroll across the screen. To exit the program, press BREAK.

Interesting variations can be made in the program by POKEing different numbers into the appropriate addresses. For example, the speed of the scrolling can be changed by POKEing a number between 7 and 255 in address 16453. The display can be given variety by changing the codes in the graphics table to their inverse codes.

GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS

Get serious about ZX81 & TS1000 Computing

with Quality Hardware and Software from Gladstone Electronics



Cassette Software

ZX FORTH

Simplicity of BASIC with the Speed of Machine Code

A complete implementation of the FORTH language for the ZX81 and TS1000 computer.
FORTH's most distinctive feature is its flexibility. The basic unit is the word — the programmer uses existing words to define his own which can then be used in further definitions. FORTH is a compiled language so programs run very fast (typically five times faster than BASIC).
ZX-FORTH is supplied on cassette and is accompanied by extensive documentation:
56-page Users Manual
8-page Editor Manual

Artic **$29.95**

ZX BUG

Machine Code Monitor and Disassembler

ZXBUG is a powerful tool for machine language programming. It is 4K long and uses memory from 71EO to the top memory. ZX BUG works in hexadecimal (base 16), not decimal, so all addresses are a maximum of 4 Hex bits long. Provides a total of 28 commands.

Artic **$14.95**

ZX ASSEMBLER

This Machine Code program occupies 7K of memory and locates itself at the top of memory. The program is a full Editor/Assembler and Monitor. Labels may be used instead of any string. The features include Line Insertion/Delete, Insert Characters, Auto Repeat on all keys. The monitor has facilities to inspect memory, registers and run machine code programs.

Artic **$14.95**

TOOLKIT

9 Powerful New Functions!

RENUMBER. This routine renumbers a program in any step and from any line up to 9999
DELETE. This command deletes a group of lines in a program.
MEMORY. Prints how much spare memory is available.
DUMP. Displays current values of string and numerical values, except arrays.
FIND. Will find any string of up to 255 characters and list each line containing that string.
REPLACE. Replaces any string of up to 255 characters by any other string.
SAVE. Transfers program in computer to below RAMTOP.
APPEND. Allows two programs to be joined.
REMKILL. Removes all REM statements from a program, otherwise leaving it unchanged, preserving memory.

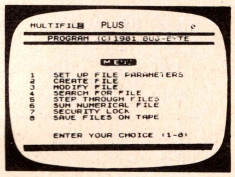
Artic **$14.95**

DATA STORAGE SYSTEM

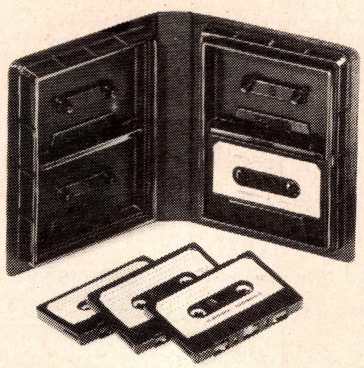
MULTIFILE PLUS

For 16K or greater ZX81

PRICE INCLUDES:
1. PROGRAM TAPE
2. 8-PAGE BOOKLET
3. THREE DATA STORAGE TAPES
4. STORAGE CASE



$34.95



Data Storage System

An amazingly versatile multi-purpose filing system for the 16K ZX81. The program is menu-driven, and number, size and headings of files are user-definable. Both string and numerical files are catered for. Files may be created, modified, replaced, and searched, and are protected by an ingenious foolproof security system. Output to the ZX printer is also provided. The program comes on cassette, together with three quality data cassettes for file storage, and comprehensive documentation, describing a host of applications for both business and personal use. Supplied in an attractive storage case. If your ZX81 is bored with playing games, then this program will give it plenty to think about!

The Complete ZX81 and TS1000 Library!

BOOKS

The Complete ZX81 Basic Course	$34.95
Basic Course Cassettes (2)	7.50
Getting Acquainted with your ZX81	8.95
ZX81 Pocket Book	10.95
Making the Most of Your ZX81	10.95
Computer for Kids, ZX81 Edition	3.95
Explorers Guide to the ZX81	10.95
ZX81 Companion	8.95
49 Exploding Games for the ZX81	10.95
Not Only 30 Programs for ZX81 : 1K	14.95
Machine Language Made Simple for Sinclair	19.95
Mastering Machine Code on your ZX81	12.95
ZX81 Rom Disassembly: Part A	14.95
ZX81 Rom Disassembly: Part B	14.95
Understanding your ZX81 ROM	19.95

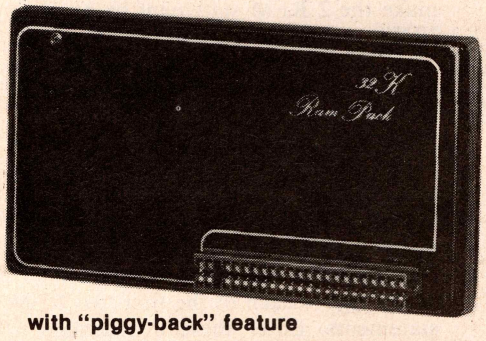
CALL OR WRITE FOR FREE CATALOG

ZX81 Professional Keyboard and Case

A full-sized professional keyboard for the ZX81 Features 47 keys and a full-sized space bar. Connects to the ZX81 with no soldering required, via a plug-in flexible connector. You can purchase the keyboard only, or the optional metal case that holds both keyboard and ZX81. Expansion devices (i.e. RAM packs, etc) connect to the ZX81 edge-connector which extends from the rear of the cabinet.
A professional keyboard makes program entry easier and less error-prone.

Keyboard (KB-1) **$85.00**
Metal case for keyboard and ZX81 (MC-1) **$25.00**

32K RAM $89.95



with "piggy-back" feature

A sensible choice for 16K RAM owners. Jigsaw 32K RAM 'piggy-backs' onto your 16K RAM to give a total memory of 48K! If you do not own a 16K RAM, you may use a 32K RAM instead. At a later date you may add the ZX81, TS1000, or Jigsaw 16K RAM, should you decide you require more memory.
A very useful, unique Jigsaw memory feature is the pilot light showing if your ZX81 computer/memory is powered.
Larger memory enables longer programs and greater data bases, enhancing the value of your personal computer. And the Jigsaw 32K is part of a fully compatible ZX81 and TS1000 system of add-on products. Additional exciting Jigsaw products to follow shortly!

64K RAM $149.95

Expands the ZX81's memory capacity to its maximum. Use instead of 16K RAM. Same features as other Jigsaw memory products including pilot light and full compatibility with other upcoming Jigsaw products.

16K RAM $49.95

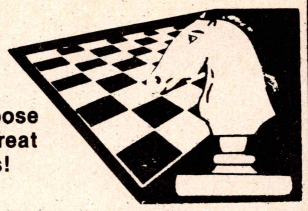
Equivalent to ZX81 or TS1000 16K RAM. Fully compatible in appearance and performance with other Jigsaw products.

GLADSTONE ELECTRONICS

Call (716) 874-5510 For Visa, MC Orders

Mail order to 1585 Kenmore Ave. Buffalo N.Y. 14217 Checks or money orders. No CODs. Add shipping

Have fun with ZX81 & TS1000 Computing



Now Choose from 3 great games!

ZX CHESS (Enhanced)

Full graphic display of chess board. Six levels of play, two of which play within competitive time limits. You choose black or white. Plays all legal moves including castling and en-passant. You can save games in progress on cassette. Displays moves of game on screen, or output yo printer, for analysis. Board can be set up in any position, you can even change sides mid-game. Clear entire board with one command: for end game analysis. Written totally in machine code, ZX CHESS (Enhanced) is a superb game for the advanced chess player.

16K **$12.95**

ZX CHESS II (CHESS MASTER)

The strongest chess game available on ZX81. ZXCHESS II has not ben beaten. All the features of ZX CHESS (Enhanced), plus much more. Has a book of 32 opening moves. Can play at 7 levels, four of which play within competition time limits. A move is suggested by the ZX81 if requested.

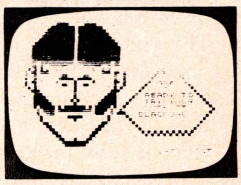
16K. **$24.95**

1K ZX CHESS

A good introduction to chess for 1K ZX81/TS1000 owners. Even within this limited memory space, a full graphic representation of the chess board is included. Single level of play. Does not accept castling or en-passant moves. **$12.95**

BLACKJACK

$14.95



Blackjack at its best. Blackjack as it played in the casinos of Nevada. Up to five players can play against a dealer with a fifty-two card deck. Split pairs, double down, and even buy insurance. The deck is reshuffled only when needed — allows for a continuous game. Your winnings and losings are displayed after each hand.

Adventure Games!

Galactic Commando	**11.95**
Crown & Scepter	**11.95**
Tank Trap	**11.95**
Slot Machine	**14.95**

Introducing KRAKIT* The Ultimate Adventure

With a 10,000 pounds sterling (real money!) pay-off

'MY SON,by the time you receive this package, I will be dead. This is my legacy to you. All my life I have worked hard to make a living and save money for your future. As you know I was an international courier. Contained on this cassette are 12 clues of an international flavor, which will furnish you with the information to gain access to a bank account. In that bank account is a minimum sum of 10,000 pounds sterling, which I have accumulated on your behalf over the years. The longer the sum remains in the account the greater the amount will become. I could have bequeathed the money to you, but I feel it is in your interest to solve these clues. Then I will feel you are mature enough an adult to handle this legacy.

God bless you always, your loving father. . .

So begins KRAKIT, the ultimate adventure and treasure hunt on the ZX81. The bank account and the prize actually exist. Crack the puzzle and the prize is yours! Krakit consists of 12 clues. In each clue there is a reference to a country, a city or town and a number. When you have solved the first clue, you will need to enter the two words and the number to release the next clue. It is necessary to solve all the clues to find the correct answer. If you do you will be supplied with two airplane tickets. When you arrive, a check for a minimum amount of 10,000 pounds sterling will be presented to you. Furthermore for every copy of Krakit sold a further dollar will be placed in the bank account.

Here is the type of clue you will find in Krakit:

'Where it all began. Where the torch was first lit. Where muscles and sinews strain. Where our heros won acclaim.

Where the symbols hold the key.'

KRAKIT.16K RAM **$19.95**

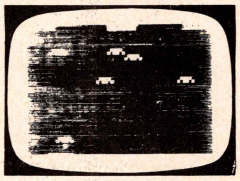
RULES. 1. The first person to be confirmed by the judges to have completed all the clues correctly will be the winner. 2. There will be one winner only. 3. No person related to I.P.S. is eligible. 4. Offer not valid where prohibited by law.

*Trademark of International Publishing & Software, Inc.

GAMES

GALAXY INVADERS

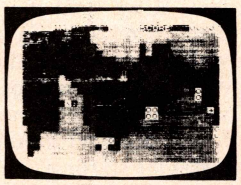
$14.95



An excellent version of the classic space game. Protect your seven lives against fleets of hostile invaders, who swoop down and attack quickly. This version is an excellent demonstration of the capabilities of the ZX81 or TS1000 to entertain and excite for hours.

ZX SCRAMBLE

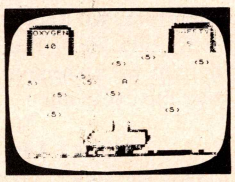
$14.95



Pilot your space craft through a fast moving, complex space maze. Watch out for missiles being fired from all directions. You can shoot back or evade them. Written in machine code for fast-paced excitement.

MARINE RESCUE

$11.95

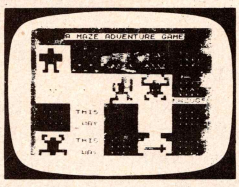


Your ZX81 becomes the command console as a diver descends to the sunken submarine Nautilus to rescue as many of the stranded crew as possible. It's a race against time as your oxygen supply must be replenished. It's also a constant battle against marauding sharks which you can attempt to blast with your laser.

MAZOGS

MAZE ADVENTURE

$9.95



A new standard in ZX81 programming. MAZOGS presents the best use of ZX81 graphics to date Written in machine code, MAZOGS is fast, exciting, and challenging!

You are confronted by a large complex maze which contains a fabulous Treasure. Within the maze are the Mazogs who will involve you in combat when you meet them. Each game begins when you meet them. Each game begins with a different randomly created maze. You will not see all of the maze. As you move through the halls, you will be startled by the quality of the graphics animation and the speed with which the game progresses.

Once you have mastered the first two levels of the game, you are ready to challenge the Maniac Mobile Mazogs who move about in a totally unpredictable manner.

To those who say the ZX81 is not a good games-player: we suggest you try your luck with Mazogs! (16K or greater)

GLADSTONE ELECTRONICS

Call (716) 874-5510 for Visa, MC Orders

ORDER FORM

CHARGE TO: ☐ VISA ☐ MASTERCARD

account number

Expiry date

Signature

Date

Please rush me:

	Quantity	Price	Total

NAME

ADDRESS

CITY: STATE: ZIP:

New York Res. add sales tax

SHIPPING

TOTAL

To: Gladstone Electronics, 1585 Kenmore Ave., Buffalo N.Y. 14217

Call or write for free TS1000 & ZX81 catalog

GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS

8K ROM
16K RAM (1K RAM)

Line Print Utility

Martin Albrecht

Reading computer-style text, where the words get chopped off at the end of the line, is easy enough once you get the hang of it. However, if the printout of a program is intended for use by people not used to this style, it is friendlier to PRINT out the text in a more legible format.

Listing 1 is a simple subroutine for the Timex/Sinclair computers that will PRINT a string text in such a way that the left margin is straight and each line ends with a whole word.

This rudimentary word-processing utility uses a pair of nested FOR-NEXT loops and exploits the unique string-slicing capabilities of the Timex/Sinclair.

Here is how it works. After the string text is registered, line 20 sends the computer to the 32nd element in the string. Since the Timex/Sinclair video format prints 32 columns across the screen, the 32nd element of the string will be at the right-hand margin of the first line of raw text. At this point (R), lines 30 and 40 start the computer counting backward (R minus K), inspecting the code of each successive string character. If code 0 (the space) is found, the machine jumps out of the K loop to line 60. Here it is commanded to PRINT the slice of A$ that starts with the 31st element counting backward from R (here, the first string element, since 32-31=1) and ends with the first space character it met on its backward search from R. This gives the first processed line of text.

The trick now is to make the machine print out the second and subsequent lines by the same rules.

Simply incrementing R by 32, thus sending the machine to the 64th string element will not do, except in the unusual case that the 32nd element happened to be a space. In the more common case, the machine has to "dump" one or more string elements in its backward count from element 32 until it encounters the first space. These "dumped" letters, of course, make up the first part of a chopped word, and they must be recovered to begin the second line of processed text. If we send the computer to string element 64 to begin its space search, we will have gone past the right-hand margin of the second line of text and be somewhere in the third line. Consequently, the letters dropped from the first line will be lost. Our starting point for searching the second line has to be not 64 (the 64th string element) but rather, 64 minus the number of dropped letters. This number is given by the value of the counter, K. Therefore, we decrement the value of R by K (line 70 of the program) and only then do we increment R by STEP 32 and start the cycle anew.

Listing 1. Line Print Utility.

```
  10 LET A$=" (YOUR TEXT TO BE P
ROCESSED) "
  20 FOR R=32 TO LEN A$ STEP 32
  30 FOR K=0 TO 32
  40 IF A$(R-K)=CHR$ 0 THEN GOTO
 60
  50 NEXT K
  60 PRINT A$((R-31) TO (R-K))
  70 LET R=R-K
  80 IF (R+32)>LEN A$ THEN GOTO
100
  90 NEXT R
 100 PRINT A$((R+1) TO )
```

Everything proceeds smoothly now until the program gets to the last line of the raw text. If, as is usually the case, this remainder has fewer than 32 elements, then the next STEP value of R would exceed its limit of LEN A$. The program therefore balks. It might be though that this could be fixed by raising the limit of R, say to the value LEN A$ + 32, but this does not work. Any element of A$ with a subscript higher than LEN A$ will not be found when the computer gets tp the PRINT command, and again we get error report 3—subscript out of range. The solution is line 80, which inspects the value of R to see whether the next incremental step would exceed LEN A$. If so, the machine is directed to line 100 with its command to print everything from R + 1 (the last space plus one) forward to the end of the string.

The ZX81 handles this slightly complex operation, in which the slicing subscripts are themselves expressions, with remarkable dispatch. It spits out the processed text at a rate of better than five lines to the second, in SLOW mode. It could be made to go marginally faster by limiting the value of K to, say, half the line (16) or even less, since there are few words of this length. But this does not seem necessary. If the string text contains a word of more than 31 letters, however, the program in its present form breaks down. If this is liable to be a problem, you can always add line

45 IF K=31 THEN PRINT A$

In other words, if the word is too long forget it!

This routine prints the text flush left, ragged right. There is a clean left margin without the leading spaces that occur in the raw text. If instead you want to print it flush right, ragged left, then enter the following lines in Listing 1:

60 PRINT TAB K; A$((R-31) TO (R-K))

100 PRINT TAB (LEN A$+1-R); ((R+1)TO#)

It should not be too complicated to add further modifications that run centered with both sides ragged or flush on both sides with the extra spaces distribution throughout the line.

By adding program line 15 PRINT A$ (and 16 PRINT for clarity) you will obtain a before-and-after comparison between the raw and the processed string.

This short utility routine shows that a computer need not be loaded with megabytes of memory to clean up its PRINT act. Of course, this routine cannot accomplish hyphenation of words. But for the modest purpose of making the PRINT output of the computer more legible to the user, it works just fine. ■

Martin Albrecht, 1143 McKinley Ave., #17, Oakland, CA 94610.

"ASTROLOGY"

FOR ZX-81/80/TIMEX (16K)

* CAST HOROSCOPES COMPLETE WITH CHART
* LOCATE PLANETS

ASTROLOGY COMPUTES THE POSITION OF THE PLANETS IN THE SKY FOR ANY TIME AND ALMOST ANY PLACE IN THE 20TH CENTURY. ALSO COMPUTED ARE SIDEREAL TIME AND JULIAN DAYS. THESE FEATURES MAKE "ASTROLOGY" USEFUL NOT ONLY FOR THE PURPOSE OF CASTING HOROSCOPES BUT ALSO TO ASTRONOMERS FOR LOCATING THE PLANETS. CAST HOROSCOPES FOR FRIENDS AND FAMILY AND PAY FOR "ASTROLOGY" MANY TIMES OVER!

DIGITAL POSI-LOAD TAPE WITH INSTRUCTIONS AND CHART $20.00

OPTIONAL—RECOMMENDED BOOK *THE ASTROLOGERS HANDBOOK* **(HARDBOUND) BY SAKOIAN & ACKER—PUB. HARPER & ROW $18.50**

H A M-A I D

ZX81/80/TIMEX (2K)

*** THE ELECTRONIC CALCULATOR**

CALCULATE REACTANCE, RESONANCE, RESISTORS IN PARALLEL, AND EVALUATE EXPRESSIONS

POSI-LOAD TAPE WITH INSTRUCTIONS $8.00

Active Designs
1108 BILTMORE DR.
NASHVILLE, TN 37204
615-297-4755

GAMES PACK

Beat this for value! Five 16K programs Plus two 1K programs

3-D Battle (M code 1K)
City Bomb (M code 1K)
Warp Wars (Basic & M code 16K)
Snake (Basic 16K)
Sweet Tooth (Basic & M code 16K)
Slalom (Basic 16K)
Black Holes (Basic 16K)

ALL ON ONE CASSETTE FOR ONLY $9.90 (£4.95)

NEW

BATTLESHIPS & CRUISERS GAME

(16K - ZX81)

First computer version of this popular game of strategy and tactics. Both grids on view together. Establish the position of your fleet then locate and destroy the computer's fleet. Visual display shows hits and misses made and gives running score.

ONLY $9.90 (£4.95)

An Essential addition to your 16K RAM ZX81

TOOLKIT (written by Paul Holmes)

Provides the following additional facilities:-

Line renumber - you state starting number and increment value.
GOTO's and GOSUB's included in line renumber.

Search and List - Searches for and lists every line containing specified character.

Search and replace - changes every occurance of a character as you require.

Free space - tells you how many free bytes you have left.

SPECIAL GRAPHICS ROUTINES

Hyper graphics mode -graphics never seen on a ZX81 before.

Fill - fills your screen instantly with your specified character.

Reverse - changes each character on your screen to its inverse video.

TAPE ROUTINE - provides a system WAIT condition until a signal is received in the cassette ear jack.

All these routines are written in machine code and together take up only 1K of your precious RAM - an incredible achievement!!

FOR 16K *ONLY $9.90 (£4.95)*

NEW

GRAPHICS TOOLKIT (another masterpiece by Paul Holmes) (ZX81 - 16K RAM ONLY)

22 exciting MACHINE CODE routines that give you control over your screen as never before!

Draw/Undraw draws or deletes your multi character shape which is defined in a REM statement. You may define as many different shapes as you like and draw or undraw each at will at whichever screen position you choose.

Foreground On/Off use this to 'protect' existing characters on your screen. When on new shapes will appear to slide behind and re-emerge from other shapes.

Border/Unborder Draws a border round the edges of your screen area. Edit lines can be used if required. Your border is protected when foreground is on.

Fill Fills any number of lines you specify, starting at any line you specify, by your chosen character.

Reverse Converts all characters to their inverse video, control as in FILL.

Print Position Controls
UP, DOWN, LEFT, RIGHT - alter your next PRINT position in the direction indicated.

Editprint Moves next PRINT position to first edit line.

Scroll facilities
UPSCROLL, DOWNSCROLL, RIGHTSCROLL, LEFTSCROLL. Scroll your screen in the direction indicated.

Onscreen/Offscreen turns your screen on or off.

Background On/Off Fills your screen by your specified character. When foreground is on existing information is unaffected and shapes will appear to pass in front of your background, without deleting it.

Search and Replace will search the screen for every occurrence of the character you specify and replace it with your new character.

Square draws a square or rectangle from your specified co-ordinates.

All these routines are in machine code for SUPER FAST response! Simply load GRAPHICS TOOLKIT, which repositions itself at the end of your RAM, and then your own program (or key in a new one). GRAPHICS TOOLKIT uses only 2K of your RAM and that includes space to load the programmers TOOLKIT described above.

ALL FOR ONLY $11.90 (£5.95)

This includes a cassette with 2 copies of the program, 2 copies of a demonstration program, plus a comprehensive instruction booklet with examples.

PLEASE NOTE ALL PRICES ARE FULLY INCLUSIVE AND ARE APPLICABLE FOR EXPORT. INCLUDING AIRMAIL POSTAGE. PAYMENT MAY BE MADE IN STERLING (MONEY ORDER AVAILABLE AT YOUR BANK) OR YOUR OWN U.S.$ CHEQUE MADE PAYABLE TO *JRS SOFTWARE*. DESPATCH NORMALLY 7 DAYS FROM RECEIPT OF ORDER.

JRS SOFTWARE

19 WAYSIDE AVENUE, WORTHING, SUSSEX. BN13 3JU Telephone: (0903) 65891

Make your Computer Speak!

Introducing the Namal Super Talker.

- Infinite vocabulary
- 560 common words dictionary
- 2K x 8 Ram Board to program your own words.
- Attractive plastic casing.
- Built in speaker
- Simple to program

Timex and Sinclair Version *Price $99.95*
Spectrum *Price $139.95* For any other computer with RS 232 Interface *Price $159.95*

MasterCard International money order or certified cheque inclusive of Postage and Packaging payable to Namal Associates

N A Namal Associates 25 Gwydir Street, Cambridge, CB1 2LG ENGLAND
Telephone: (0223) 355404 Telex: 817445

Please rush me (Quantity). . . . . Timex/Sinclair Super Talker@ $99.95
Please rush me (Quantity). . . . . Spectrum Super Talker@ $139.95
Please rush me (Quantity). . . . . RS 232 Computer Super Talker@ $159.95
Add Postage and Packaging $4.50 I enclose $ .....

Name _____ Signature _____

Address _____

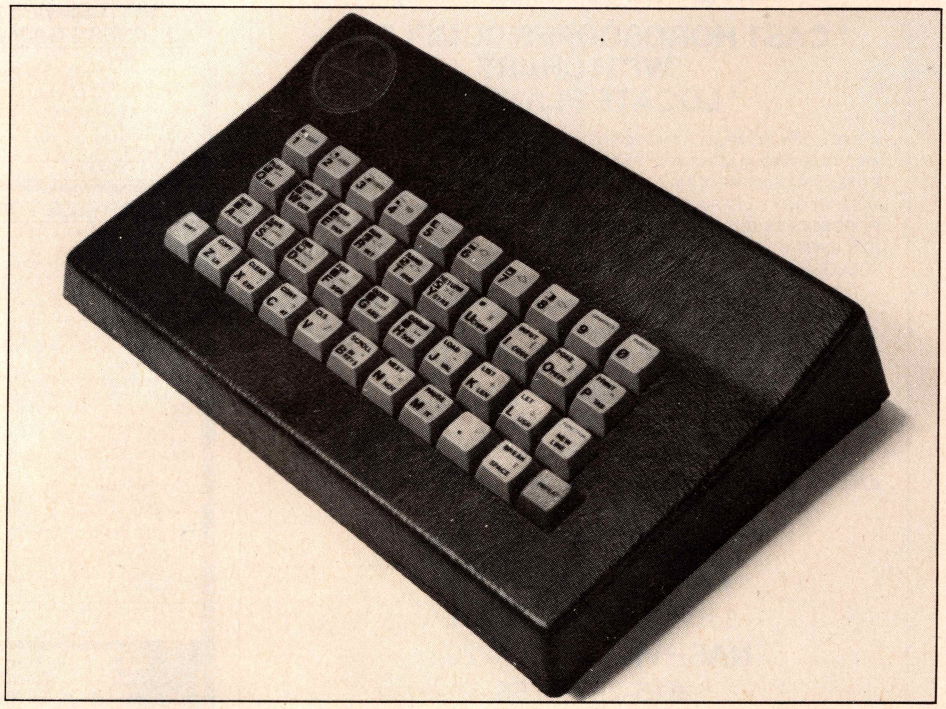
_____ S/N/D/ST

Hardware Breakthrough!

* **ZX-Man**
$14.95

* **Joystick**
$14.95

* **Keyboard**
$74.95
full-size assembled w/leatherette case



FULLY ASSEMBLED KEYBOARD

1) Fully assembled
2) Includes Key Cap Legends
3) 30 Day Warranty
4) 2X80/ZX81 compatible
5) Some soldering necessary

THE INNOVATORS ARE COMING

Call or Write for more information

American Express, Visa, Master Charge, Money order, pc (allow 2-3 weeks to clear)
Please add $2.50 postage & handling
Illinois residents please add 5% Ill. sales tax

Visit our Showroom 10:00 - 6:00 Monday thru Saturday

AMERICAN EXPRESS Cards Welcome

VISA

MICROCOMPUTERS PLUS, INC.
349 EAST MAIN ST.
GALESBURG, IL 61401
PHONE: (309) 342-9572

master charge THE INTERBANK CARD

Large Letters for the 8K, 2K Machine

Joe Carroll

Getting personal and small business computers out into homes and small offices depends on having software support available. The software writer must use his imagination and every tool he can find to make his programs self-prompting, fast, and easy to use.

One tool that has been useful to me is a Basic subroutine to create 4x4 characters for the 8K ROM. The routine works well enough and enhances the display. However, it is slow. If used repeatedly, the delay can be irksome. The annoyance is not user-friendly! The obvious solution is to write a machine language subroutine to do the work.

Getting Organized

Like many solutions, this created new problems. The first step was to write a development program. I came up with a flexible, menu driven, decimal, hexadecimal machine code loader, reader, and reviewer.

Next a decision had to be made about where to hold the machine code. I decided to use REM statements. This is the most convenient and sturdy way, and the code can be easily SAVEd. There are a few drawbacks though which will be taken up later.

Dimensioned arrays were chosen as the best way to store the original and expanded strings. Arrays are easily addressed from the Basic program, of course, and, when entered as the first variables, they can be addressed by the machine code program by indexing from the VARS pointer. Each dimensioned array will keep its size and indexed position from the VARS pointer constant.

The Initial Listing

Let us look at the following program which shows the general organization of the program.

```
 1 REM (at least 32 bytes)
 2 REM (150 to 160 bytes)
10 DIM A$(8)
12 DIM X$(128)
```

1 REM will contain 32 graphics characters used to build each expanded character.

2 REM is the body of the machine code subroutine, about 141 bytes plus spares.

10 DIM A$(8) is the first variable loaded into VARS. It is loaded from a Basic program with the characters to be expanded. The address of the first element of A$ is (VARS)+6, PEEK 16400 + 256 * PEEK 16401 + 6. The file name and all use the extra six bytes.

20 DIM X$(128) is the second variable loaded into VARS. It is loaded by the machine code routine from A$ to form 8 expanded characters, 16 bytes per character. It forms 4 lines of 32 characters. The address of the first element in X$ is (VARS)+20.

Brief Program Description

The program first finds the address of A$ and X$, then clears X$. X$ is divided into 8 4x4 blocks. For each inverse character in A$, the corresponding 4x4 block in X$ is coded for the inverse character set. Next, it finds the address of the character generator for each character in A$. The character generator for a space, CHR$0, starts at 7680 and has 8 bytes of all zeros. The character generator for the letter A, CHR$38, starts at 7680 + (8 x 38) = 7984 and looks like this bit pattern:

```
7984 00000000
7985 00111100
7986 01000010
7987 01000010
7988 01111110
7989 01000010
7990 01000010
7991 00000000
```

64 characters are generated this way. All other characters are combinations or inverses of these 64.

The program divides this bit pattern into 16 blocks and loads each bit pattern one bit at a time into X$. Now each element in X$ has a value between 0 and 31, which represents a graphics character in 1 REM. The last part of the program uses this value to load that character back into X$.

Loading the Program

To load the machine code, enter the REM statements as follows:

1 REM followed by at least 32 characters and a few spares.

2 REM followed by at least 150 to 160 characters. (The character entered is immaterial. One convenient way of entering is to use 1234567890 and repeat the sequence until the required number is reached. In this way you can easily count how many have been entered.)

Then to find the addresses of these REM statements, add the program in Listing 2, hit ENTER, and RUN 1000. After you find the addresses, write them down. No, not on the blotter. Be organized and keep notes that you can refer to later. The 1 REM statement should start at 16514.

Figure 1 gives the hexadecimal and decimal listings to load into 1 REM. The first 16 are graphics characters for normal characters. The next 16 are inverse characters. If you are using the decimal machine code loader in Listing 1, hit RUN, and enter the numbers from the decimal column in Figure 1.

The next step is to load the body of the program into the 2 REM statement. Since it is about 141 bytes long, reserving about 160 bytes in 2 REM is recommended. There is a step near the end of the program that contains the code 7Eh (126d). This code will exist in a REM statement, but it will not display when listed and neither will the next five codes. This is no problem for the program unless you try to EDIT 2 REM or change the length of 1 REM. This can cause the last six bytes of the program to disappear. Having extra bytes at the end of the program can save you trouble if you have to POKE the last six bytes back in. PEEKing is the only way to find out if they are still there.

Earlier in the program is the code 7Fh (127d). The only problem this can cause is that it prevents you from driving the cursor past that point. If it is necessary to do so, just POKE a zero into that address, then remember to POKE 7Fh (127d) back later. Using the editor is certain to cause the loss of the last six bytes.

The body of the program is divided into four parts for analysis and trouble shooting.

Part 1. Initializing

Part 1 is not very complicated. It finds the addresses of A$ and X$, then clears X$. Figure 2 is the hexadecimal listing; Figure 2a, the decimal. Load Part 1 into the 2 REM statement (remember where you wrote that address?). If you are using Listing 1, change line 110 to read:

```
110 FOR A=P1 TO P1+22
```

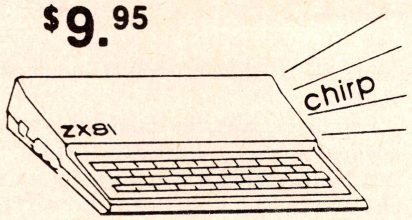
P1 is the address of the second number found in running Listing 2 above. The program will run itself if you add a return code to the end of Part 1: C9h (201d). Again save the addresses for use in Part 2.

Now RUN the Basic program to load A$(8) and X$(128) into the VARS area. Before you RUN the machine code program, *SAVE it on tape.*

To test Part 1, enter PRINT USR X as a command (X is the address of the 2 REM statement) and press ENTER. You should get 14 on the display with a 0/0 error code; and PRINT X$ should return four lines of empty spaces, regardless of what was in A$ or X$ before, and a 0/0 error code. If you got all this, you are ready for Part 2.

Joe Carroll, 3422 Mimosa Ln., Huntsville, AL 35810.

$9.95



CHIRPER module for your ZX81 or your timex/sinclair 1000.

The CHIRPER module lets you enter keyboard data fast and accurately. A sound can be heard when a key has been entered enabling you to spot a double entry or missed entry without looking up at the screen.

The CHIRPER sound is produced when a program runs. A key entry results in a buzz-like chirp on 1K or 2K machines. Large programs in a RAM pack produce a continuous sound that chances pattern on key entry.

The CHIRPER module installs easily inside the ZX81 case with only 3 wires to connect. Complete installation instructions included.

Send a check or money order. We pay the postage in the U.S.A. or canada.

AUDIOGRAPH CO.
3584 Leroy, Ann Arbor, MI 48103

ZX80 ZX81 TIMEX MICROACE

CRASH NOT. WANT NOT.

Have you had unexplainable system crashes? Lost programs due to brownouts or power failures? Or just plain tripped over your electric cord?

If so, you need an uninterruptable power supply.

UPSYSTEMS is a battery powered backup system that kicks in **automatically** as soon as its sensors detect a drop in voltage coming from your power supply. Your system keeps on ticking.
Simple to install and use. Just plug your power cord into **UPS** and plug **UPS** into your system and you are ready for any power glitch or failure. (Additional cord included).

All systems include on/off/reset switch for your convenience (you no longer have to unplug your computer to reset it). All systems are compact, approx. 13 cm x 7 cm x 4 cm (5⅛" x 2⅝" x 1⅝").

UPS-1 Economy system, uses 2-9 volt alkaline batteries (not included). $14.95 + $2.00 shipping, handling & insurance.

UPS-1M Same as **UPS-1** except it includes a **P**rogram **L**oading **M**onitor to solve your tape loading problems. $19.95 + $2.00 S, H&I.

UPS-2 **NiCd** system that recharges itself automatically (NiCd battery included). $29.95 + $3.00 S, H&I.

UPS-2M Same as **UPS-2** except it includes a **PLM**. $34.95 + $4.00 S, H&I.

90 Day Guarantee on Parts and Labor.

Check or money order payable to: **UPSYSTEMS**. Foreign orders add $1.00.

UPSYSTEMS
RA BANKS
5800 HOLLISTER
DEPT 1901
HOU TX 77040

If, on the other hand, the program crashed, reLOAD what you SAVEd. Now check to see if the "Push" and "Pop" codes balance. (See Figure 2, source statement column.) These codes push and pop two bytes on and off the machine stack. The stack also contains the address to return to Basic. So if the Push and Pop codes do not balance, the machine will not return to Basic.

Error code 2/0 after PRINT A$ or PRINT X$ indicates that the variables area has been altered. Check the A$ and X$ address loaders.

Part 2. Inverse Character Check

Part 2 checks each element in A$ for inverse characters. For any inverse character found in A$, the corresponding 4x4 block in X$ is incremented. This increment will cause Part 4, the interpreter, to use the inverse graphics section of the 1 REM statement.

Load Part 2 immediately after the last byte of Part 1. If you ended Part 1 with the return code, C9h (201d), replace it with the first step of Part 2, or POKE a zero (NOP code) in its place. Otherwise the program will not run beyond Part 1. Figure 3 is the hexadecimal listing; Figure 3a, the decimal listing. If you are using Listing 1, change line 110 to:

110 FOR A=P2 TO P2+38

P2 is P1 + 22. Write down the address of P2 + 38 for use as P3 in Part 3 below.

To test Part 2, end it with the return code, C9h (201d), as we did for Part 1. PRINT USR X should return 28 on the display with a 0/0 error code. PRINT X$ should return 4x4 empty spaces for each normal character in A$, and 4x4 blocks of CHR$1 for each inverse character.

If you do not get this, or if the program crashes, use the same procedure used to

Figure 1. Contents of 1 REM statement (Hex).

Hex Code	Decimal	Comment
16514	00	0
16515	37	135
16516	04	4
16517	83	131
16518	02	2
16519	85	133
16520	06	6
16521	81	129
16522	01	1
16523	86	134
16524	05	5
16525	82	130
16526	03	3
16527	84	132
16528	07	7
16529	80	128
16530	80	128
16531	07	7
16532	84	132
16533	03	3
16534	82	130
16535	05	5
16536	86	134
16537	01	1
16538	81	129
16539	06	6
16540	85	133
16541	02	2
16542	83	131
16543	04	4
16544	87	135
16545	00	0

Listing 1. Decimal Machine Code Loader.

```
100 REM MACHINE CODE LOADER, DE
CIMAL
110 FOR A=16514 TO 16545
120 IF PEEK 16442<3 THEN SCROLL

130 PRINT A,
140 INPUT DEC
150 POKE A,DEC
160 NEXT A
170 STOP
```

Listing 2. REM statement address locater.

```
1000 FOR F=16509 TO 16700
1010 IF PEEK F=234 THEN PRINT F+
1
1020 NEXT F
```

Figure 3. Inverse character sorting routine (Hex).

Hex Code	OP Statement	Comment
D5	PUSH DE	; save A$ addr
E5	PUSH HL	; save X$ addr
01 1C 08	LD BC NN	; A4 Chr counter
C5	PUSH BC	; save Chr cntr
1A	LD A (DE)	; code A$
13	INC DE	; next A$
D5	PUSH DE	; save A$ addr
E5	PUSH HL	; save X$
FE 7F	CP N	; check for inverse
38 0D	JR NC	; jump if not
06 04	LD B N	; X$ row cntr
C5	PUSH BC	; save X$ row cntr
06 04	LD B N	; X$ column cntr
34	INC(HL)	; mark inv chr
23	INC HL	; next X$
10 FC	DJ NZ	; loop column ctr
09	ADD HL BC	; next X$ row
C1	POP BC	; row cntr
10 F5	DJ NZ	; X$ row loop
E1	POP HL	; X$ addr
01 04 00	LD BC NN	; X$ chr disp
09	ADD HL BC	; next X$ addr
D1	POP DE	; next A$ addr
C1	POP BC	; Chr cntr
10 E1	DJ NZ	; Chr loop
E1	POP HL	; X$ addr
D1	POP DE	; A$ addr

check Part 1. Do not forget to SAVE everything on tape before you RUN anything. If you got everything except the 4x4 blocks of CHR$1 for inverse characters, check to see whether you forgot to remove or replace the return code after Part 1.

Part 3. Bit Shuffling

Part 3 is the most complicated part, and the heart of the whole program. It locates the Character Generator in the 8K ROM for each character in A$. Then it shuffles each bit from the Character Generator to the proper address in X$.

Figure 2. Initializes program by getting addresses of A$ and X$ (Hex).

Hex Code	OP Statement	Comment
2A 10 40	LD HL (NN)	; VARS pointer
01 06 00	LD BC NN	; disp to A$
09	ADD HL BC	; A$ addr
E5	PUSH HL	; save A$ addr
0E 0E	LD C N	; disp to X$
09	ADD HL BC	; X$ addr
E5	PUSH HL	; save X$ addr
3E 00	LD A N	; zero A reg
06 80	LD B N	; X$ size
77	LD(HL) A	; zero X$ addr
23	INC HL	; next X$ addr
10 FC	DJNZ	; X$ loop
E1	POP HL	; X$ addr
D1	POP DE	; A$ addr

Figure 2a. Initialization (Decimal).

42	229
16	62
64	0
1	6
6	123
0	119
9	35
229	16
14	252
14	225
9	209

Figure 3a. Inverse character sort (Decimal).

213	13	245
229	6	225
1	4	1
28	197	4
8	6	0
197	4	9
26	52	209
19	35	193
213	16	16
229	252	225
254	9	225
127	193	209
56	16	

Figure 4. Bit shuffling loops (Hex).

Hex Code	OP Statement	Comment
06 08	LD B N	; A$ chr cntr
C5	PUSH BC	; save A$ chr cntr
1A	LD A (DE)	; A$ chr$
E6 3F	AND A	; mask A<64
13	INC DE	; next A$ addr
D5	PUSH DE	; save next A$ addr
E5	PUSH HL	; save X$ addr
21 F8 1D	LD HL NN	; Chr$ gen addr-8
11 08 00	LD DE NN	; Chr$ gen addr incr
47	LD B A	; loop counter for
04	INC B	; Chr$ gen addr
19	ADD HL DE	; A$ Chr$ gen addr
10 FD	DJ NZ	; loop for Chr$ gen
EB	EX DE HL	; A$ Chr$ gen in DE
E1	POP HL	; X$ addr
06 04	LD B N	; dbl row cntr
C5	PUSH BC	; save dbl row cntr
06 02	LD B N	; single row cntr
C5	PUSH BC	; save sngl row cntr
1A	LD A (DE)	; 1 byte of Chr$ gen
E5	PUSH HL	; save X$ addr
06 04	LD B N	; 2 bit cntr
17	RLA	; 1 bit from Chr$gen
CB 16	RL (HL)	; 1 bit into X$
17	RLA	; 1 bit from Chr$gen
CB 16	RL (HL)	; 1 bit into X$
23	INC HL	; next X$ addr
10 F7	DJ NZ	; loop 2 bit cntr
E1	POP HL	; X$ addr
13	INC DE	; next Chr$gen addr
C1	POP BC	; single row cntr
10 ED	DJ NZ	; loop sngl row cntr
01 20 00	LD BC NN	; X$ row incr
09	ADD HL BC	; next X$ row
C1	POP BC	; dbl row cntr
10 E3	DJ NZ	; loop dbl row cntr
11 7C 00	LD DE NN	; X$ disp
ED 52	SBC HL DE	; X$ addr new chr
D1	POP DE	; A$ addr
C1	POP BC	; A$ chr cntr
10 C4	DJ NZ	; loop A$ chr cntr

STAR VENTURE GAME:

Seek out and destroy enemy vessels to move up in Star Fleet ranks.
Program listing $2.95
Cassette ..... $4.95 & $1.00 shipping

OTHER PROGRAMS AVAILABLE
SASE for Brochure
Dependable Load monitor $4.95
8K/16K, ZX80/ZX81.

DSBC
P.O. BOX 1251
DOLAN SPRINGS, ARIZONA 86441

ZX81

NEWSLETTER

EVERY MONTH OUR SUBSCRIBERS RECEIVE

programs – projects
reviews – articles
and more!
SAMPLE ISSUE AND FREE PROGRAM

Z-WEST

send $1.00 (shpg.)
BOX 2411 VISTA, CA 92083

"For Adults Only"

An adult program to add spice to your life. Not a game, but an aid to better understanding of your lovers desires. You'll enjoy this program if you enjoy loving . . .

$19.95 + 1.50 p&h
Florida resident add 5% tax

HAYMARKET SOFTWARE CO. • P.O. BOX 14026 • JACKSONVILLE, FLORIDA 32238

The key to the bit shuffling is in two codes: 17h, RLA and CB 16,RL (HL). RLA shifts each bit in Register A (in the CPU) one place to the left, and overflows to the Carry Flag (in the CPU). The bit that was in the Carry Flag rotates back to Register A. RL(HL) works the same way using the byte at the address in Register HL.

Part 3 uses several loops to load Register A with a byte from the Character Generator and load Register HL with an address in X$. Then the RLA code shifts one bit from the Character Generator to the Carry Flag, and RL (HL) shifts that bit into the address in X$. Four bits are shifted, one bit at a time, into each of the 128 addresses in X$. If shuffling 512 bits into 128 addresses sounds a little tedious, I assure you, the whole program runs faster than you can blink.

Figure 4 is the hexadecimal listing for Part 3. Figure 4a is the decimal listing. Enter Part 3 the same way as you entered Part 2. Be sure to remove or replace the return code, C9h (201d), from the end of Part 2. If you are using Listing 1, change line 110 to:

110 FOR A=P3 TO P3+62

P3 is the address plus 38 from Part 2. Write down the address for Part 4.

If you have been doing well so far, enter Part 4, the interpreter, too. It is only 19 more steps.

If you add the return code, C9h (201d), and test the program, you should get the same display as before, except PRINT X$ should return four lines of characters between CHR$0 and CHR$31 for each character in A$ that is not an empty space.

If you went ahead and loaded Part 4, the interpreter, PRINT X$ should return the finished product, an exact 4x4 enlargement of each character in A$. Note that Part 4 already ends with the return code, C9h (201d). Troubleshoot as before.

Figure 4a. Bit shuffling loops (Decimal).

6	4	23	0
8	25	203	9
197	16	22	193
26	253	23	16
230	235	203	227
63	225	22	17
19	6	35	124
213	4	16	0
229	197	247	237
33	6	225	82
248	2	19	209
29	197	193	193
17	26	16	16
8	229	237	196
0	6	1	
71	4	32	

Listing 3. 1 REM and 2 REM.

```
   1 REM (32 GRAPHICS CHARACTERS
)
   2 REM (141 PROGRAM STOPS)
  10 DIM A$(6)
  12 DIM X$(128)
  14 LET X=16540
```

Listing 4. Sample application.

```
100 PRINT "ENTER PHRASE"
110 INPUT A$
112 CLS
120 LET L=USR X
130 PRINT A$
140 PRINT
150 PRINT X$
160 PRINT
170 GOTO 100
```

Part 4. The Interpreter

Part 4 is the shortest and easiest part of the program. It has only one loop. It loads the HL Register with the 1 REM statement address. The 1 REM statement holds the graphics characters that build each 4x4 character. For each address in X$, the value at that address (0 to 31) is added to HL. The graphics character found at HL + (0 to 31) is then placed into X$. This will loop 128 times to interpret each element of X$.

If you are using Listing 2, make this change:

110 FOR A=P4 TO P4+18

P4 is P3 + 62.

Figure 5 is the annotated hex listing for Part 4. Figure 5a is the decimal listing. Part 4 contains the code 7Eh (126d) which will not display in a REM statement. Neither will the next five characters, but they do exist in the REM statement and will run in a machine language routine.

Remember that using the EDIT key on 2 REM or moving 1 REM can cause you

ANNOUNCING a new software program for TIMEX/ SINCLAIR TS1000 and SINCLAIR ZX81 computers. (Requires 16K RAM memory pack)

LOST IN SPACE

by Michael C. Hoffman

You're the captain of an experimental space ship that can't be detected by enemy ships.
Suddenly, an electrical fire is reported by the navigator. It is quickly extinguished, but the damage is severe.
The auto-pilot, main engine and laser gun won't respond, so you switch to manual and auxiliary thrusters. The only working controls are the rotate right and left thrusters. Checking the status monitor indicates only 30 lbs of fuel is left.
During the crisis, your ship wandered into a meteor shower. You must maneuver left or right to avoid hitting meteors and enemy ships.
Your new mission is to locate the fleet of friendly fuel ships and attempt to land on one in order to refuel and continue the journey.

FEATURES:

Rotate right and left thrusters. 2 types of meteors. 2 types of enemy ships. 1 fleet of friendly fuel ships. 10,000 bonus points. Bonus game. 30 lbs bonus fuel. Status monitor for fuel and score (Real-time). Auto-run. Many prompts. Manual replay. Moving graphics. Flicker-free. Moving graphic title for the beginning and end of program.

CONTROLS: **Press key #**

Rotate right thruster 8
Rotate left thruster 5
Status monitor for fuel left and score ..... Ø
Manual replay (When prompt asks if you want to play another game; yes or no?) ..... Y (**ENTER**) (or) N (**ENTER**)

As you steer past the meteors and enemy ships, you accumulate valuable points. Try to land on a fuel ship to refuel (30 lbs bonus fuel) and continue into hyperspace. (10,000 bonus points will be added to your current score and to the new game already in progress.)

"LOST IN SPACE" is prerecorded on a computer certified cassette tape, in a protective see through ABS plastic case. GUARANTEED LOADING. Included is our detailed instruction manual.
(File name) **"LIS"** $11.95
(Please add $1.50 for shipping and handling. NJ residents 5% tax.)
(Dealers wanted.) M.C.HOFFMAN CO., PO BOX 117, OAKLAND, NJ 07436

PREMIUM DATA CASSETTES

MANUFACTURERS WHOLESALE PRICES

LENGTH	10-PACK	100-PACK	500-PACK
C-10	.59EA.	.54 EA.	.45 EA.
C-20	.66	.61	.53
C-60	.89	.83	.79
C-90	$1.29	$1.21	$1.14

SOFTWARE PUBLISHERS —LET ACTS AUDIO PROVIDE YOU WITH ALL YOUR CASSETTE PRODUCTION REQUIREMENTS.

CUSTOM SOFTWARE DUPLICATION — FOR SINCLAIR, TRS-80, APPLE, ATARI — GUARANTEED TO LOAD.

ACTS AUDIO ALSO SELLS HIGH-SPEED DUPLICATION EQUIPMENT MODIFIED FOR SOFTWARE DUPLICATION.

ACTS AUDIO, INC.
70 WEST ILLIANA AVE.,
ORLANDO, FL. 32806
(305) 423-0338

Pay by check, Mastercharge or Visa. Add $5 for C.O.D. shipments. Florida residents add 5% sales tax. No shipping to P.O. Boxes. Shipping by U.P.S. to continental USA only. For shipping and handling add $2 for 10 pack, $5 for 100 pack, $12 for 500 pack.

TS1000-ZX81 OWNERS

KRAKIT™

WIN $20,000 or more

KRAKIT™ is an adventure and a treasure hunt for the ZX81 and TS1000 computers. The bank account and prize money actually exist. Be the first to crack the puzzle and the prize is yours. Only one prize will be awarded.

SOLVE 12 CLUES LIKE THIS!

Where it all began. Where the torch was first lit. Where muscles and sinews strain. Where our heros win acclaim. Where the symbols hold the key.

KRAKIT™ consists of 12 clues on a ready-to-run ZX81 or TS1000 cassette tape (16k RAM). The answer to each clue is the name of a country, a city or town, and a number. If you are the first qualified entrant to solve all 12 clues and declared the winner, you receive two tickets to the city of the secret KRAKIT™ vault location. When you arrive at that location, a check for a minimum amount of $20,000.00 (U.S.) will be presented to you. The amount of the prize money is augmented weekly.

TS1000-ZX81

RULES

1. The first qualified entrant to be confirmed by the judges to have completed all the clues correctly is the winner.

2. There will be one winner only.

3. No persons connected to International Publishing & Software Inc. or their families are eligible to enter KRAKIT™

4. This offer is not valid where prohibited by law.

5. Due to the confidential nature of KRAKIT™ we regret we are unable to enter into any individual correspondence. All the required information, including how to claim the prize, is on the computer tape.

6. The winner will be required to sign an affidavit of compliance with these rules.

INTERNATIONAL PUBLISHING & SOFTWARE INC.
P.O. BOX 1654, BUFFALO, N.Y. 14216

Mail to:
INTERNATIONAL PUBLISHING & SOFTWARE INC.
P.O. BOX 1654, BUFFALO, N.Y. 14216

Please send _____ copies of KRAKIT™ at $19.95 plus $1.50 shipping.

Total _____ enclosed is ☐ check ☐ money order

Charge to ☐ Visa ☐ Mastercard

Number _____

Expiry _____ Signature _____

Please print:

Name _____

Address _____

City _____ State _____

Zip _____

Allow 2 weeks for personal checks.

Dealer inquiries welcome.

other FINE PRODUCTS from INTERNATIONAL PUBLISHING

3952 Chesswood Drive
Downsview, Ontario, Canada M3J 2W6

• GAMES • GAMES • GAMES •

MARINE RESCUE: fast action underwater
TANK TRAP: destroy enemy planes & land mines
GALAXY INVADERS: repel fleets of invaders
INVADERS: the classic computer game
ZX SCRAMBLE: a fast-moving space game
CROWN & SCEPTER: a medieval adventure
GALACTIC COMMANDO: a space war adventure
TRACK DOWN: an adventure in the old west
BLACKJACK: as played in Vegas
SLOTS: beat the one-armed bandits
ZX CHESS I: 6 levels: black or white: save games
ZX CHESS II: chess master: 7 levels: champion rated
1K CHESS: 1 level: no castling or en-passant
PLANET OF FEAR: find your stolen spaceship
INCA CURSE: get gold out of the temple
SHIP OF DEATH: free your ship from an alien cruiser
NANTIR RAIDERS: arcade game: 4 waves of attackers
GOBBLE MAN: famous arcade game: chase ghosts in a maze
1K GAMES: 11 games for unexpanded ZX81/TS1000
SHOOT OUT: how fast are you "on the draw"

FAMILY EDUCATION & HEALTH & ENTERTAINMENT

WEIGHT CONTROL: a personalized weight loss program*
CONSTELLATION: your computer is your telescope*
SOLAR SYSTEM FILE: a databank on the solar system*
BIORHYTHMS: plot your physical, emotional, intellectual cycles*
BOOK OF DAYS: facts, trivia, birthdays in a datafile*
PERSONAL RECORDS STORAGE SYSTEM: create a personal datafile*
FLASHCARD: memory aid, learning aid, testing device
MOVIE HANGMAN: guess the movie; beat the Hangman

PROGRAMMING AIDS

Z-AID 1.0: a machine code programming aid
ZX BUG: for debugging, editing & running machine codes
ZX ASSEMBLER: powerful tool for machine code programs
TOOLKIT: add 9 commands to basic; including renumber
ZX FORTH: ease of basic with machine code speed*

** comes complete with a detailed guide*

DEALER ENQUIRIES INVITED.

Figure 5. Interpreter (Hex).

Hex Code	OP Statement	Comment
21 06 00	LD HL NN	; X$ disp
19	ADD HL DE	; X$ addr
EB	EX DE HL	; X$ addr in DE
06 80	LD B N	; X$ loop cntr
21 82 40	LD HL NN	; 1REM addr
1A	LD A (DE)	; X$ coded byte
85	ADD A L	; increment HL by
6F	LD L A	; X$ chr code
7E	LD A (HL)	; get graphics chr
12	LD(DE) A	; put into X$
13	INC DE	; next X$ addr
10 F5	DJ NZ	; X$ loop
C9	RET	; return to BASIC

Figure 5a. Interpreter (Decimal).

```
33      26
6       133
0       111
25      126
235     18
6       19
128     16
33      245
130     201
64
```

Listing 5. Four Times Square Billboard.

```
100 PRINT "ENTER MESSAGE"
102 INPUT I$
104 CLS
106 LET I$=I$+" *** "
110 FOR F=1 TO LEN I$
112 CLS
120 LET A$=A$(2 TO 5)+I$(F)
130 LET L=USR X
140 PRINT AT 10,0;X$
150 PAUSE 20
152 POKE 16437,255
160 NEXT F
170 GOTO 110
```

to lose the last six bytes of the machine code. You will have to PEEK to see if they are there. The program will crash if they are not. If you do lose them, just POKE them back.

Using the Program

The whole program is 141 bytes long, and, if you are careful, there is no reason you cannot load the whole thing at once. I described it in four parts to show you how each part worked and how to troubleshoot. Turn now to Listing 3. The address of the first byte of the body of the program is 16540 because there are a few spare bytes in the 1 REM statement. If yours is different, do not change your program to use 16540. Change X to equal your address.

The easiest application is to add the short routine in Listing 4 to Listing 3. After entering the program and running it, I think you can start to appreciate its speed. Still you could do the same thing with a Basic subroutine. It would just run a little slower.

Now try Listing 5. If you have the improved ROM you can omit line 152; if you have SLOW mode, you can omit lines 150 and 152. After you have entered and run this listing, you will see how versatile the program can be. Now try *that* with a Basic subroutine. The machine code makes all the difference. It is fast enough for repeated use without slowing down the display. Another idea is to modify the 1 REM statement to create special print, such as segmented characters. With a few extra basic steps, you could even perform a double expansion, which would display two 16x16 characters.

It is time to use your imagination. You may already have several programs that would benefit from large letters, perhaps an educational program that rewards correct answers with a big "ATTA BOY!"

If you have never used machine code before, go ahead and get your feet wet with this one. You will find that your programs are more user-friendly, and that this machine code subroutine is so easy to use. It could be called programmer-friendly.

I would like to hear of your trials and tribulations with this program, care of *SYNC* Magazine. ■

1982 TAX RETURN HELPER

A set of 7 ZX81/TIMEX programs (16K RAM) for the 1982 tax return. Data is interactively entered/examined/modified and the results can be immediately seen. The programs perform all computations and even detect some of your errors. Like in an electronic spreadsheet, when you make a change, all the lines affected by it are updated on the spot. So you can explore "what if" alternatives. Or you can add a deduction remembered at the last moment and get that entire form corrected without effort. The forms can be printed and/or saved on tape for future use. Form 1040 and Schedules A, B, C, C1/C2, D and E are featured.

The 1982 edition will be available in January 1983. The cost - $14 - is tax deductible. (Only $7 for the buyers of the 1981 edition.)

ARTIST

ARTIST is a ZX81/TIMEX (16K RAM) program that, with more than 30 commands helps create drawings/paintings on screen. Features include: 4 modes (DRAW, ERASE, MOVE with user defined step, PAINT with user defined brush); 8 directions of movement in every mode; background fill; position save and recall; easy graphic specification of lines, circles and half-circles; ability to define, store and recreate complex patterns anywhere on the screen; ability to save the artwork on tape or print it.

ARTIST is very easy to learn and use. 4-year-old kids master its basic commands in minutes. Most commands require pressing of only one key (no enter needed) and numeric coordinates are not necessary. No knowledge of Basic is needed. At the same time, advanced features support the creativity of sophisticated users, which can define their own commands; for them, ARTIST offers an extensible graphic command language. User defined commands can be nested (even recursively) and are saved on tape.

Cassette and instructions - $10 ($12 outside U.S.).

From: **KSOFT**, 845 Wellner Rd., Naperville, IL 60540

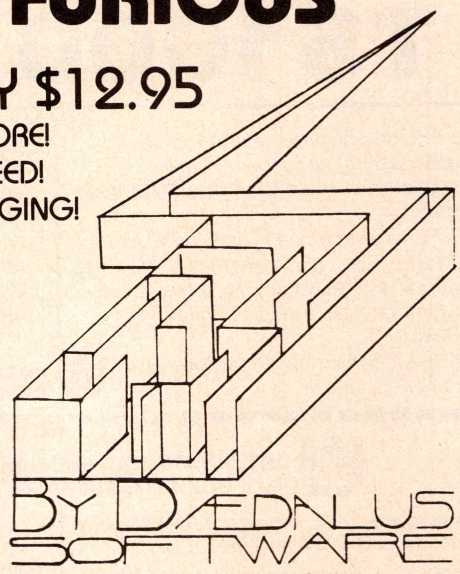
NEW! Fast Action Game of Skill

FURIOUS

ONLY $12.95

HIGHSCORE!
HIGHSPEED!
CHALLENGING!

ZX81
16K RAM



BY DAEDALUS SOFTWARE

Send Check or Money Order for $12.95
Plus $1.50 for Shipping and Handling to:

DAEDALUS SOFTWARE
8442 Cozycroft
Canoga Park, California 91306

from

MIKRO-GEN

the leaders in ZX games

Scramble

The high-speed arcade game. Easily the fastest available. 32 zones, thrust and altitude controls.

Supplied on cassette, with library case

ONLY $7.95

Other great ZX games and add-ons from Mikro-Gen:

Space Invaders
the best you can get, with ever-increasing rate of play

Breakout
with seven bat angles to make it really difficult

Bomber
positively addictive

ZX Chess
The original – and still the best!

Sorcerer's Castle
takes you into a world of magical adventure

Above games all supplied on cassette, with library case

$7.95 each (ZX Chess $12.95)

A/D Converter Board
Lets you connect analogue joysticks to the ZX81 digital inputs. Suitable for many other applications, easy to connect – and it improves RAM pack stability!

ONLY $36.95

Joysticks
Connect via our A/D Board – makes your ZX81 a true programmable games machine

ONLY $18.95 EACH

Disassembler/Monitor
An absolute must when learning machine code – lets you enter and run your own code

ONLY $7.95

Write for full details of the Mikro-Gen range of programs and add-ons, available from local stockists or direct from the manufacturers (please make cheques/PO's payable to Mikro-Gen and add $1.90 postage for software, $3.50 for hardware

Suppliers of Software to Sinclair

MIKRO-GEN

24 Agar Crescent Bracknell Berks RG 12 2BK, England
Tel: Bracknell (0344) 27317

Unique Software for your consideration...

VIRTUOSO . . .

a music synthesis program with ten octave range at any tempo to accommodate songs up to 96 notes. Recordable pulse waves generated at a mike jack. Can be heard or amplified on any TV. Uses a single BASIC instruction. SAVE YOUR SONGS! Hardware? Any cassette recorder.

KALEIDOGRAPH . . .

enjoy kaleidoscopic simulation in a 22 x 22 pixel display composed of randomly selected graphic pixels with two axes and an exciting center of symmetry.

Both for Timex Sinclair 1000; ZX80/81; 8K; ROM; 2K+; RAM computers. Each only $6.95 pp. Add $3.00 ex-U.S.A.

Quantity: Virtuoso _____ Kaleidograph _____

Name: _____

Address: _____

City/State/Zip: _____

Remittance to: William Don Maples
688 Moore St., Lakewood, CO 80215

TS1000 AND ZX81 OWNERS

20 PROGRAMS: $9.95
BAR CHART, ETCH-A-SCREEN, INTEREST, SPELLING, CHECKBOOK. . . AND 15 MORE!

EXTENDED MEMORY *NOT* REQ'D!

11SY82

SEND CHECK OR MONEY ORDER

TO:

COMPUTHINK, INC.
P.O. Box 603
Hopkins, MN 55434

I'VE GOT A # TS1000 ☐ ZX81
(CHECK ONE)

QTY	DESCRIPTION	COST
	20 PROGRAMS CASSETTE $9.95 EA	
	20 PROGRAMS MANUAL $13.95 EA	
	BEST BUY! BOTH $19.95 SET	
	SHIPPING AND HANDLING	1.25
	TOTAL (MN RESIDENTS ADD 5% SALES TAX)	

SHIPPING LABEL — PLEASE **PRINT!**

NAME _____

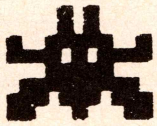
STREET _____

CITY _____ STATE _____ ZIP _____

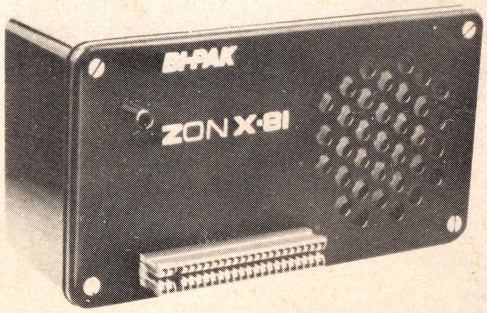
SOUND with ZX~81!

SOUND with ZX-81!

MAKE AMAZING SOUND EFFECTS WITH YOUR ZX-81



Timex
Sinclair
1000



$49.95
Incl. airmail postage

THE ZON X-81

* The ZON X-81 SOUND UNIT is completely self-contained and especially designed for use with the ZX-81. It just plugs in—no dismantling or soldering.
* No power pack, batteries, leads or other extras.
* Manual Volume Control on panel—ample volume from built-in loudspeaker.
* Standard ZX-81—16K Rampack or printer can be plugged into ZON X-81 Sound Unit without affecting normal ZX-81 operation.
* Huge range of possible sounds for games or: Music, Helicopters, Sci-Fi, Space Invaders, Explosions, Gun-shots, Drums, Planes, Lasers, Organs, Bells, Tunes, Chords, etc., or whatever you devise!
* 8 full octaves. Uses 3-channel sound chip giving programme control of pitch, volume of tones and noise, all with envelope control.
* Easily added to existing games or programmes using a few simple "BASIC" lines or machine code.
* No memory addresses used—I.O. mapped.

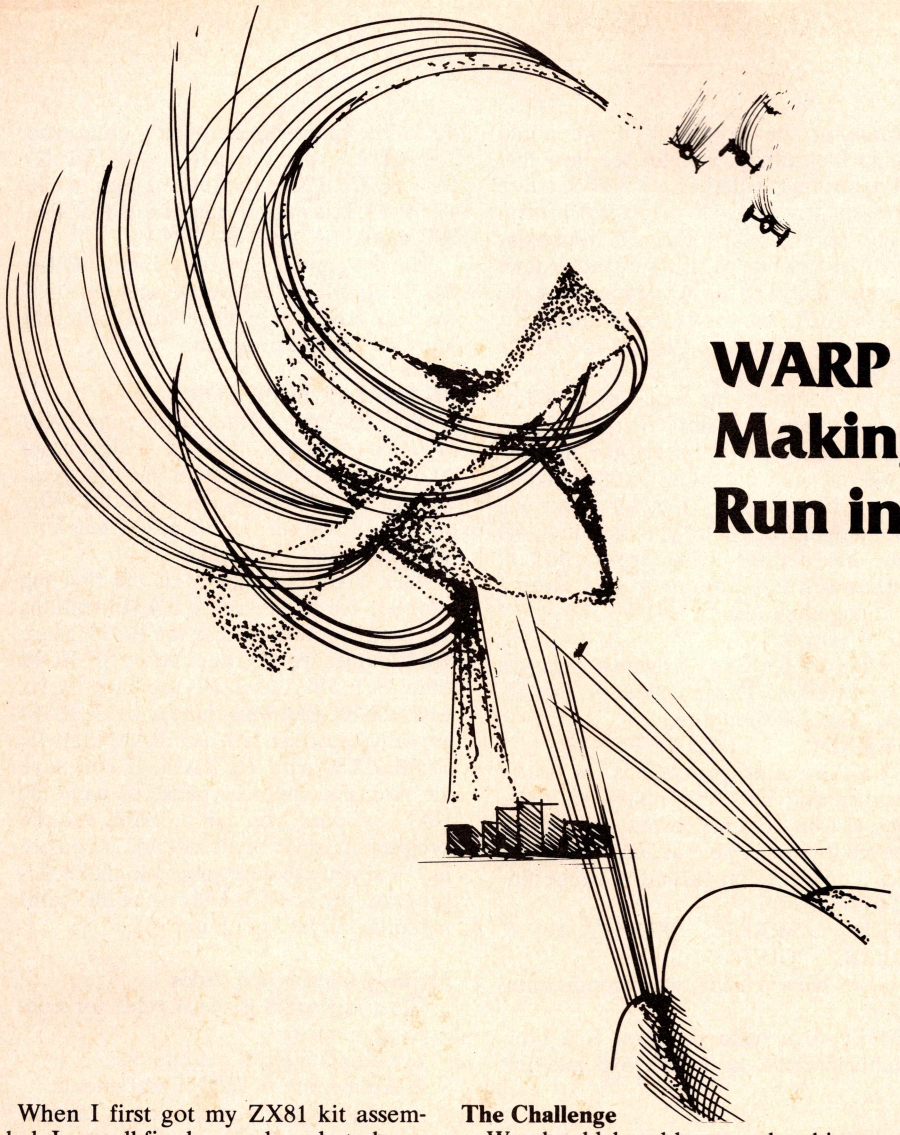
FULL Instructions with many examples of how to obtain effects and the programmes, supplied. Fully Guaranteed.

Payment may be made by Bank Cheque or International Money Order in U.S. $ or £ Sterling Payable to:

BI-PAK

P.O. Box 6
Ware, Herts
England
Phone #0920-3182

Visa-Mastercard accepted
Send account #
with name & address



WARP 81: Making a 4K Program Run in 8K

Chuck Bonner

When I first got my ZX81 kit assembled, I was all fired up and ready to learn programming. I planned to buy books with titles like "97 Ready-to-Run Games in Basic" at ten for a dollar. They are usually far from "ready-to-run," but debugging them is an excellent way to get started with a new computer. Unfortunately, programs that fit into 1K RAM are relatively hard to find.

When the May/June issue of *SYNC* arrived, some possibilities opened up with "Space Warp" by Armando Fox. I scanned the article, paying particular attention to the last paragraph, which described the clever way of storing the graphics for the spaceship. Then I entered Listing 1 according to the instructions. POKEing the values listed in the article went fine until the eleventh value (zero). Suddenly, the screen went blank, and the keyboard had no effect! I unplugged the computer and started over, with the same results.

A Mystery

Why can't I set up the graphics as Mr. Fox did? Looking at the article again, I finally noticed that it was for the 4K ROM.

Chuck Bonner, 145 Allen St., Norfolk, VA 23505.

The Challenge

We should be able to make this program run in the ZX81. Let's give it a try.

First, what is the difference between 4K Basic and 8K Basic? Obviously, 8K machines have something in memory locations 16427 to 16441 which should not be changed. Other than that, the listing has things like "GO TO" and "GO SUB" instead of "GOTO and "GOSUB". No problem. Also, the way random factors are entered in lines 200, 210, 260, and 660 of Listing 2 is different from the way it appears in the *ZX81 BASIC Programming* manual. Will it work? Enter

```
200 LET F=F-W*RND(3)
```

No, it will not work. What about line 450?

```
IF S THEN GOSUB 600
```

Entering this line yields no syntax error, so IF S THEN . . . is a valid instruction. Translating all the random factors into 8K Basic is an easy first step.

POKEing Problems

We will probably find other differences as we proceed, but for now, back to the original mystery. Is there something about these values that, altogether, they cannot be POKEd into the specified locations, or is it only that one particular location which cannot be POKEd to zero? Referring to Listing 1, and counting the values listed in the article, we can see that the problem comes when we POKE 16437,0. So, with no program in the computer, do just that. After a couple of seconds, the screen goes blank and the keyboard has no effect. Why can't we POKE 16437,0 on the ZX81 if Mr. Fox can on his ZX80?

The answer has to do with the ROM. The ROM chip contains most of the information which allows the microprocessor to communicate with "the outside world" and vice versa. I say "most" because many ROM subroutines use RAM as a "scratch-pad." Therefore, certain locations must be left alone, or else the computer will not behave properly. 16437 is one of them. If you have a listing of the ROM subroutines, and you are really clever, you can use this glitch to make your computer do some surprising tricks. For examples, refer to any "Try This" program which contains a POKE statement.

Are there any other "sacred cow" RAM locations? Probably. What are they? If you are curious, enter the program in Listing 3. Save it on tape before you run it. Running it must eventually cause the program to crash, because eventually you will POKE the memory locations which contain the program. Watch the screen for anything unusual. When it happens, BREAK the program and remember the last location displayed. LIST the program (if possible) to see if you have destroyed it. POKE the last location to 0 with no program in the computer to see if it has the same effect. To try more locations, LOAD Listing 3 from tape and change the first value of X in line 10 to the next one after the location which caused the program to crash. Watch for particularly unusual responses from 16384 (whether

or not the program is loaded) and 16398 (only if the program is loaded).

Meanwhile, back to "Space Warp." Since we cannot POKE 16437,0, the computer probably cannot put a 61 there (computer talk for "X"). In the article we learn that Listing 1 substitutes the graphics characters designated by the numbers in the last paragraph of the article for the fifteen X's in line 1. If the X's do not go into locations 16427 to 16441, then where do they go? To find out, enter the program in Listing 1 below. Then add line 1 from Listing 1 for "Space Warp" and delete line 40. This program will PEEK every location in RAM (16384=16K; the beginning of RAM). Watch the screen until you see fifteen "61's" in a row. If the screen gets full (it will), hit CONT. Using this program, we find our fifteen X's in locations 16514 through 16528. These values of X must be used in line 40 of Listing 1.

Now, if the graphics for our spaceship are not saved in the place we were told, we cannot get them out of that place either. Examining the program, we see that the spaceship is drawn from the PEEK in line 380. Change it to

PRINT CHR$ (PEEK (16513+N))

Additional Problems

There are four other little problems in translating the program. The article says that the Killer Satellite is represented by a double asterisk. Where is the double asterisk in the program? If we study Listing 2 carefully, we can see how line 260 determines whether a Killer Satellite is present, and line 440 prints it. Unfortunately, on the ZX81 this will represent the Killer Satellite as "LLIST" rather than a double asterisk (see Appendix A of the *ZX81 BASIC Programming* manual). So, we have to substitute 216 for the 226 in line 260.

Now, consider the odds of a Killer Satellite being present. In 8K Basic, RND*6 may equal (almost) any number between 0 and 6 including 0 but excluding 6 (see Ch. 5, p. 24). Therefore, you will absolutely never get a Killer Satellite. 4K Basic has a different interpretation of RND as well as a different syntax. Even if we change line 260 to

IF RND*6=5 . . .

the odds are 65,536 to 1 against getting a Killer Satellite. That is too easy. For 8K Basic, line 260 should read

IF RND*6 5 THEN LET S=216

The third little problem is the status report in line 300. Apparently, 4K Basic gives a four-column format in PRINT statements with commas. Our 8K Basic gives a two-column format. Change line 300 to read:

PRINT "WARP", "FUEL", W, F, "VELOC", "DIST", V, D

Now we have a neat two-column status report.

The fourth little problem is a typographical error. Both line 390 and line 420 in the spaceship drawing routine read "NEXT X", and there is no "NEXT N" for line 370. Using the information in Ch. 12, p. 63, it is easy to figure out that line 390 should be the "NEXT N".

The program is now fully corrected for 8K Basic. Note: before we are through, we will cover one more little problem after we run the program.

4K ROM

Listing 1: Setting the Variables.

```
 1 REM XXXXXXXXXXXXXXX  (15 X's)
10 LET D=1000
20 LET D2=0
30 LET F=100
40 FOR X=16427 TO 16441
50 INPUT P
60 POKE X, P
70 NEXT X
```

4K ROM

Listing 2: Space Warp.

```
100 PRINT "WARP?"
110 INPUT W
120 IF W>15 OR W<1 THEN GO TO
    110
130 PRINT "DIRECTION?"
140 INPUT D$
150 IF NOT (D$="F" OR D$="R") T
    HEN GO TO 140
200 LET F=F-W*RND(3)
210 LET V=(W/2)*(RND(5)+5)
220 LET D1=V*(W/2)
230 IF D$="R" THEN LET D1=-D1
240 LET D=D-D1
250 LET S=0
260 IF RND(6)=6 THEN LET S=226
270 LET D2=D2+D1
280 IF D<0 THEN LET D=0
290 CLS
300 PRINT "WARP", "FUEL", "VELO
    C", "DIST", W, F, V, D
320 PRINT
330 FOR X= -4 TO 6
340 FOR J=1 TO D2/40
350 PRINT "#";
360 NEXT J
370 FOR N=X+5 TO X+9
380 PRINT CHR$ (PEEK (16426+N));
390 NEXT X
400 PRINT
410 LET X=X+4
420 NEXT X
425 FOR L=1 TO 25
430 PRINT "#";
435 NEXT L
440 PRINT CHR$ (S)
450 IF S THEN GO SUB 600
460 IF F<1 THEN STOP
470 IF D<1 THEN GO TO 500
480 GO TO 100
500 PRINT , "HOME FREE"
510 STOP
600 IF W>7 THEN GO TO 660
610 PRINT "RETREAT?"
620 INPUT D$
630 IF D$="N" THEN GO TO 660
640 LET D=D+V*(W/2)
645 LET F=F-W
650 GO TO 670
660 LET F=F-(RND(5)*3+W)
670 RETURN
```

1K RAM on the 8K ROM

Now just try to enter it on your ZX81 or Timex/Sinclair 1000. You will run out of memory in the middle of line 630, yet it runs in 1K RAM with the 4K ROM. Why will it not run on the 8K ROM machine which also has 1K RAM?

This is another aspect of the first big problem we had. Certain RAM locations are used as scratchpad by the ROM. More RAM scratchpad is required by 8K ROM than 4K ROM (this is only logical). Therefore, the 8K ROM machine with 1K RAM actually has much less user RAM than 4K ROM ZX80 with 1K RAM. If you have an extension memory pack, or have 2K RAM onboard, you can probably run the program as is. If you do not and if you are like me, you are determined to make this program run in 1K RAM on the 8K ROM machine. So let's get busy!

Memory Conserving Rules

Here are some general rules for conserving memory:

1) Eliminate REM statements.

2) Abbreviate in PRINT statements.

3) Eliminate any repetition of mathematical expressions.

4) Do not make the program enforce the rules of a game. Trust the player to stay within limits.

5) Simplify as much as possible.

Now let's apply these rules to "Space Warp."

First, the only REM statement is the one we need to hold the spaceship graphics. So we will keep it (for now).

Next, we have the PRINT statements. We can abbreviate some of them without making them too hard to understand. In line 130 PRINT "F/R?" is enough. In line 500 PRINT, "HOME".

Now let's look for repetition of mathematical expressions. If a variable is set as equal to a certain expression, all repetitions of that expression can be replaced by the variable. For example; in line 220, D1 is set equal to V * (W/2). Therefore, line 640 can read

LET D=D+D1

and still mean exactly the same thing. If there is an expression which is repeated often, it might be worthwhile adding the variable to the program.

Is the program is enforcing the rules of the game? Look at line 120. This can be deleted if we remember that our warp must be between 1 and 15. By the same

GRAB BAG PROGRAM SALE!

We're overstocked on 16K programs so we're going to sell them cheap. These are all good quality, name brand programs.

We have games, simulations, programmers' aids, word processors, music composers, data base, etc.

Why not try your luck and see what you get?

$8.50 for 1

$16.50 for 2

$24.50 for 3

Add $1.50 for shipping and handling.

If you write

GOOD

Timex/Sinclair

PROGRAMS

or

You build

QUALITY

HARDWARE

or

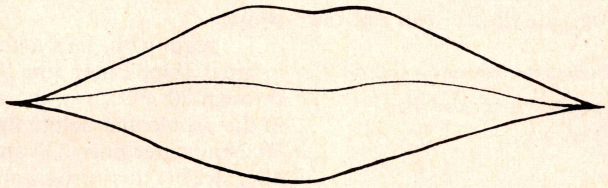
You are a dealer

then

We'd like to hear from you.

Free Hardware and Software catalogs. *(specify)*

The Lip



DOES YOUR RAM pack have that dreaded disease — ***The Wobbles?***

DO YOU have problems with your computer suddenly becoming absentminded, berserk, obstinate, rude and unruly due to poor contact?

DO YOU find yourself screaming at the kids, your spouse, your pets, the world, because you fear someone may bump the table?

Sinclair Place has the answer — *The Lip*! The Lip is a feature of the Audio Computers 16K RAM pack. The Lip fits over the upper edge of your TS1000 or ZX81 to lock on and eliminate wobble and connector problems. Not only is The Lip a superior performer; it is an inexpensive solution to ***The Wobbles***.

Money back guarantee if not satisfied.

$48.00 plus $1.50 shipping and handling.

Yes, send me *The Lip*. Enclosed is $48.00 + $1.50 shipping and handling.

NAME _____

STREET _____

CITY _____

STATE _____ ZIP _____

Send me _____ programs.

Sinclair Place P.O. Box 2288 • Redmond, WA 98052

token, we can eliminate line 150 if we remember that the direction must always be either "F" or "R". Our abbreviation in line 130 makes that rather clear anyway.

After all this abbreviation and contraction of the program, we still run out of memory on line 650. Is there anything we can simplify? Look at the routine for drawing and positioning the spaceship. It takes up over 105 bytes in 11 lines!. If we can simplify this, it will be well worthwhile.

Listing 3. Finding the Sacred Cows.

```
10 FOR X=16390 TO 17408
20 PRINT X,
30 PRINT PEEK X,
40 POKE X,0
50 NEXT X
```

Listing 4. Warp 81.

```
 10 LET D=1000
 20 LET D2=0
 30 LET F=100
100 PRINT "WARP?"
110 INPUT W
200 LET F=F-W*RND*2
210 LET V=(W/2)*((RND*5)+5)
220 LET D1=V*(W/2)
240 LET D=D-D1
250 LET S=0
260 IF RND*6>5 THEN LET S=216
270 LET D2=D2+D1
290 CLS
300 PRINT "WARP",,"FUEL",W,F,"VE
LOC",,"DIST",V,D
320 PRINT
380 PRINT TAB D2/40;"▄▄"
440 PRINT TAB 20;CHR$ S
450 IF S THEN GOSUB 600
460 IF F<1 THEN STOP
470 IF D<1 THEN GOTO 500
480 GOTO 100
500 PRINT ,,"HOME"
510 STOP
600 IF W>7 THEN GOTO 660
610 PRINT "RETREAT?"
620 INPUT D$
630 IF D$="N" THEN GOTO 660
640 LIST D=D+D1
645 LET F=F-W/2
650 GOTO 670
660 LET F=F-RND*W
670 RETURN
```

To begin with, let's take a look at the original ship. Enter line 1 and lines 40 through 70. POKE in the numbers listed in the article and delete lines 40 through 70. Now enter lines 330 and 370 through 420. RUN this program. Apparently, either Mr. Fox has an unusual notion of what a spaceship should look like, or the numbers we POKEd into line 1 do not designate the same graphics characters on the ZX81 as on the ZX80. We must choose to change (and simplify) the spaceship, or to boldly go where no man has gone before in a John Deere wheat combine. If you do not think it looks like a combine, add these lines:

430 PRINT AT 2,4; "Y" (graphics)
440 PRINT AT 2,4; "T" (graphics)
450 GOTO 430

If you do not want to harvest at warp 15, I can let you have a small economy-size flying saucer which was owned by a little old lady who flew it to Titan on Saturdays. It can be yours for only 13 bytes. Delete line 1 and lines 330 through 420. Enter a new line 330:

PRINT TAB D2/40; "DGD" (graphics)

Our spaceship is now smaller, requires much less memory, and looks more like a spaceship. Unfortunately, when we RUN the program, we run out of memory before we even see the spaceship. So we must simplify a little more.

That memory-saving way to draw the spaceship gives me an idea. Why not use the same technique for the Killer Satellite? We cannot simply PRINT "**", because then we would see the Killer Satellite whether or not line 260 said it was there. We can, however, delete lines 425 through 435, and change line 440 to read

PRINT TAB 20; CHR$ S

This gets us a little closer, but not enough. Perhaps we can simplify something in the 600 subroutine. Let us look at what happens when we are asked "RETREAT?" If we answer "Y", then we retreat automatically. There is never any need to input "R" in line 140. Therefore, we can eliminate all references to D$ without affecting the game one bit. Delete lines 130, 140, and 230.

The program still will not run so let's simplify a little more. Again in the 600 subroutine, if we retreat, we lose a fixed number of fuel units (equal to our warp), but, if we charge past the Killer Satellite, the computer uses a rather complex formula to determine how much fuel we

BART TRUEHEART, WHERE ARE YOU?

In the Space Opera series games you are Bart Trueheart, the greatest genius hero of Earth. With your companions, the Kindly Old Professor (KOP) and his Beautiful Young Daughter (BYD) you travel the spaceways in your faithful ship, *The Rover of Space*.

But this idyll cannot last . . . you have enemies. The cunning Little Green Men (LGM's) of By-Orl and the brutish Bug Eye Monsters (BEM's) of Milkorf have joined forces to form ***THE MALTRAXIAN ALLIANCE***.

Earth is depending on you to thwart their evil plans.

SO1: **THE MALTRAXIANS ATTACK**

You, as Bart Trueheart, must stop the fleet of the Maltraxian Alliance before it can concentrate and attack Earth. Time is limited and so are your resources. You have only your faithful ship, *The Rover of Space* and whatever you can capture from the enemy.

CAN YOU SAVE THE EARTH?

Ten levels of play.

$9.50

SO2: **RAID ON COLONY ALPHA**

BEM's have entered the life support dome of Earth's first interstellar colony. You, Captain Trueheart, must lead the few space marines stationed on Alpha. If the invaders are not repelled, Earth's colonization programme will end.

Fighting under the dome, you must clear the colony of invaders . . . but be careful, if the dome is pierced no one will survive.

$9.50

"ADVENTURE" STYLE GAMES:

SOA1: **DETENTION STATION INTRAG**

The professor's Beautiful Young Daughter has been captured by the Maltraxians and imprisoned in the dreaded *Detention Station Intrag*.

You must enter this orbital prison, find BYD and free her. Then, most difficult of all, you must escape with her from the alerted station.

This is no task for the fainthearted; only you, Bart Trueheart, could even consider such a dangerous rescue.

CAN EVEN BART TRUEHEART SUCCEED?

$13.95

SOA2: **ESCAPE FROM THE DARK SYSTEM**

You, Bart Trueheart, along with the Kindly Old Professor and his Beautiful Young Daughter have been marooned in a space-lifeboat in the fearsome **Dark System**.

Your only hope is to boldly land where no man has landed before . . . on Nekros, a LGM colony planet and to steal one of their starships.

You must evade surveillance satellites, police, security and military forces while finding a ship to take you home. There is little chance of success but what else can you do?

$13.95

All games are for ZX81 16KRAM

All games include cassette instructions and designer's notes.

Add 10% for postage and handling.

Send cheque or money order to:

TURNER, ELCY & COM.,
P.O. Box 395
Port Huron, MI

MAKE YOUR SINCLAIR A PORTABLE COMPUTER SYSTEM

MAC (MOHR & Associates Corporation) Now Offers You A Durable, High Impact ABS Plastic Briefcase That Measures 17½" X 12¼" X 4½". Wired For 110-60HZ And Ready To Be Used!
You Merely Insert Your Sinclair Components (Including Printer) In the Preformed Cavities And BINGO You Have A Portable Computer System. The Briefcase Has Slots For Tapes, Coax Cable And The TV Adapter.

$149.95 Includes Shipping & Handling.
Kansas Residents add 3% Sales Tax.

TO ORDER
SEND CHECK OR MONEY ORDER
MOHR & ASSOCIATES CORP.
645 N. Baltimore
Derby, KS 67037
(316) 788-1526/788-3165
MC/VISA ACCEPTED

THE EXPLORER'S GUIDE TO THE ZX81

If you have ZX81 then you need this book (120 Pages).

1K and 16K Programs.
Games and Application.
RAM and I/O Circuits.
Programming Hints
ROM Routines.

$11 from:

TIME DATA
3 - Waldon Road
Califon, N.J. 07830

Enclosed _____ Check/M.O.
Name _____
Address _____
City _____ State _____ Zip ___

ANALYSIS

STOCK SELECTION GUIDANCE

Now Available! Fundamental Stock Analysis

No HOCUS POCUS Charting involved! No requirement to update data daily, weekly or even monthly! With ANALYSIS and your 16K ZX-81/TS-1000 you can make sound BUY/HOLD/SELL investment decisions at your convenience. ANALYSIS uses information readily available in your newspaper and at your local library. ANALYSIS and your ZX-81/TS-1000 provide you with a decision support tool equivalent to those used by professional investment advisors.

Fundamental Analysis centers about the premise that a security's price performance is dependent upon its expected future earnings growth. ANALYSIS projects compounded earnings growth based on historical data using LINEAR REGRESSION techniques. A security's present price is compared to price ranges based on projected earnings. An Upward/Downward movement ratio as well as a BUY/HOLD/SELL recommendation is provided as output.

YOU CANNOT AFFORD TO BE WITHOUT THIS TOOL! (Tape and Tutorial $17.95).

PORTFOLIO

Investment Portfolio **Performance Analysis,**

File Management Capabilities with your ZX-81/TS-1000 (16K)

PORTFOLIO provides a powerful tool that transforms your 16K ZX-81/TS-1000 into a sophisticated Investment Data Bank. Track stocks, bonds, mutual funds. Maintain accurate records of # shares, cost, and set selling price targets. Tracks up to 50 securities. MENU-driven record management capabilities to ADD, CHANGE, DELETE or DISPLAY selected records. Automatically list the entire file, one record at a time, viewing tableaus of security attributes including value, cost and percentage gain. MENU-driven file management capabilities allow you to input current market prices and recalculate overall portfolio performance and individual security performance as well. Save and Restore file contents to and from cassette.

A MUST for any ZX-81/TS-1000 owner who maintains an investment portfolio. (Tape and Tutorial $15.95)

Send check , money order to:

ORIONS'S BELT Enterprises
807 N. Fairway Road
Glenside, PA 19038

(Add $1.00 postage and handling)

software by Zebra X-ray

Are you ready to kick the arcade game habit? Are you frustrated by adventure games that wear you out just entering your moves? THEN TRY THIS ONE!!

You are the STAR HUNTER. You are the only one who can prevent a galactic disaster. You've been hired to find an artifact of fantastic importance. The fate of an entire interstellar empire depends on your success or failure. You must traverse many locations on several worlds, each in a different star system. You are alone and you start out unarmed. On top of all of this, your star-jumps are accomplished with matter-transfer booths--a most unreliable and therefore dangerous method of travel. The odds against survival and/or success are rather high.

This adventure requires 16K RAM/8KROM and can be loaded into the ZX-81 or the TIMEX SINCLAIR 1000.

STAR HUNTER is both easy and fast to play, but it does require the use of your other computer....THE ONE YOU CARRY AROUND BETWEEN YOUR EARS!!!

Star Hunter

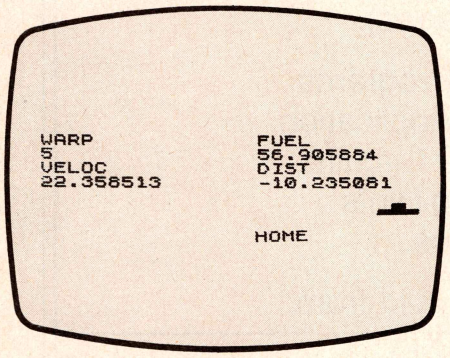
Is different-
·It plays fast
·Its user friendly
·Its all in basic
And its only $9.95

Send $9.95 per tape to:
Zebra X-Ray Software
Box 585
Chattanooga,Tn. 37401

lose. This formula should be random to keep the game adventurous; there must be a chance of coming out ahead by daring. But it really does not have to be so complicated. Change line 660 to read

LET F=F-RND*W

Now the fuel taken by the Killer Satellite depends on how fast we are going, and on



how lucky we are. However, since RND is always less than 1, we will always come out ahead by daring. Where is the thrill in a sure thing? Change line 645 to read

LET F=F-W/2

Now it is a toss-up whether retreating will be better or not.

Try to RUN the program now. We are making progress, but we are not finished yet. Take a look at line 280. What good is it? It ensures that our "Status Report" will never indicate that we have passed home base. Line 470 will stop the game if we pass home base. If it is a choice between not playing the game and seeing a negative distance, I will just delete line 280.

Halleluiah! It works!

Now play the game a few times, How many did you win? None? Why not? Even without Killer Satellites in the program, you always run out of fuel. This goes back to the differences in the way random factors are handled in the 4K and the 8K machines. We could change line 30 to give ourselves more fuel, but 100 is nice to use. The other solution is to change line 200 to change the rate of fuel consumption. If it reads

LET F=F-W*RND*2

we have a game which is not only playable, but winnable.

Conclusion

Many of the lessons we have learned here are applicable to other programs, too. Any short program you find in a book or magazine, whether for the ZX80 or any other small computer, can usually be translated into 8K Basic. Watch for integer Basics (4K Basic is one) where all fractional numbers are rounded off.

Watch for PRINT AT, PRINT TAB, and PLOT statements. They will never be the same on two different computers. However, they can be used if you know where they should be on the screen and if you use the appropriate values for the ZX81.

When you have to shorten a program, which will be often, follow the same general procedure we used here. Be suspicious of long mathematical formulas and long program lines. Try to figure out why the person who originally wrote the program used each line, and you may find a shorter way to do it. ■

From "Space Warp" by Armando Fox
(*SYNC* 2:3)

This program runs in 1K, but it must be entered in two parts. The first part is the "set variables" section shown in Listing 1. Enter this short program and RUN. Enter the following values to be POKEd to the REM statement in line 1: 0, 3, 10, 0, 0, 132, 128, 150, 139, 10, 0, 132, 3, 133, 6. Then hit LIST. Line 1 will look like a jumble of graphics symbols; these draw the ship. Now delete lines 40 through 70 (*not* 1 through 30) and continue by entering the main program in Listing 2. To run the program, simply type RUN; since the graphics are stored as a REM statement, there is not much that can cause these variables to be cleared, except for NEW. ■

INCREASE YOUR ZX81 PROGRAMS WITH INFINITY
4 K or more

BOUNCY Entrapped by the mad scientist, Count Von Der Bouncy, it is up to you to fight off his bizarre creations known as snogel balls and try to regain your freedom.
$7.95*

NIGHT DRIVER Test your driving skills on a desert road. Through difficult turns and blinding curves, find out how good you really are.
$7.95*

CASINO/STOCKMARKET Now you can play the slot machines, keno, roulette, blackjack, and more right in your own living room/then see how well you can deal in the stock market. Be a millionaire in one night.
$9.95*

MISSILE STRIKE Defend against enemy missiles & satellites seeking to destroy innocent cities. You are the commander of a land-based missile defence center. The fate of the world lies in your hands.
$7.95*

***(All orders should include $1 for postage and handling. Out of the U.S., include $2 for postage and handling.)**

California residents, please add 6½% sales tax.

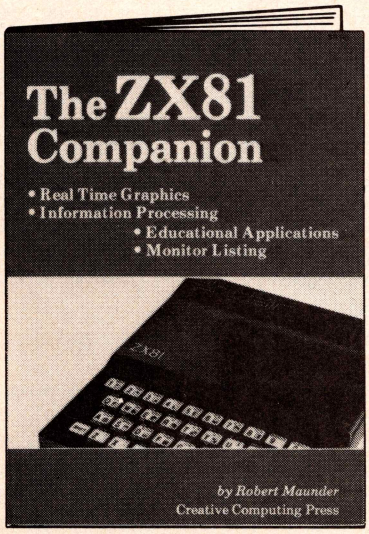
Infinity Research Development
845 Via de la Paz, Suite A120
Los Angeles, Ca. 90272

INFINITY

FREE XMAS GIFT
TO ZX/TS USERS
SEND STAMPED &
SELF-ADRESSED
ENVELOPE TO:
YAGSEE (Dept C)
POB155
VICKSBURG
MICH 49097

Get the most from your SINCLAIR

with these practical, program-filled books from *Sync*!



The ZX81 Companion

by Bob Maunder

The ZX81 Companion follows the same format as the very popular *ZX80 Companion,* and assists the ZX81 user in four applications areas: graphics, information retrieval, education and games. This practical guide contains scores of fully documented short routines plus complete programs and a disassembled listing of the ZX81 ROM Monitor. "Thoughtfully written, detailed, and illustrated with meaningful programs."—MUSE

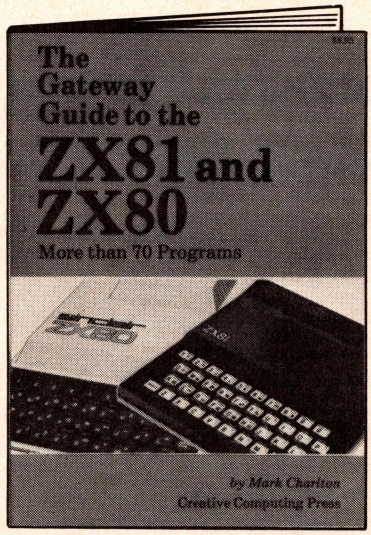
5½"x8", 132 pages. #17P $9.95 ($2.00)

Getting Acquainted With Your ZX81

by Tim Hartnell

This informative volume for the new ZX81 user contains more than 70 programs to help the reader get the most from his Sinclair computer. Game programs include Checkers, Alien Imploders, Blastermind, Moon Lander, Breakout, Star Burst and Derby Day. The book also shows programs for cascading sine waves, plotting graphs and tables, data sorting, equation solving, plus the use of PLOT, SCROLL, PRINT, TAB, PEEK, POKE and much more!

5½"x8", 120 pages. #15Y $9.95 ($2.00)



The Gateway Guide to the ZX81 and ZX80

by Mark Charlton

The Gateway Guide is a practical programming manual for the beginner that furnishes over 70 fully documented programs. The majority of the programs have been written for easy conversion from machine to machine (ZX81, 4K ZX80 or 1K ZX80). *The Gateway Guide* describes each function and statement, illustrates it with a demonstration routine or program, and combines it with previously discussed material to help you understand your computer.

5½"x8", 172 pages. #160 $9.95 ($2.00)

Computers for Kids (Sinclair Edition) by Sally Larsen

This new edition of *Computers for Kids* is written specifically to introduce children aged 8 to 13 to the ZX81. The book requires no previous knowledge of algebra, variables or computers, and it enables a youngster to program a ZX81 in less than an hour. There's also a section for parents and teachers. "*Computers for Kids* is the best material available for introducing students to their new computer."

—Donald T. Piele, Professor of Mathematics, University of Wisconsin-Parkside.

8½"x11", 56 pages. #12S $4.95 ($1.00)

All volumes are softbound.

Creative Computing Press Dept. NA7F, 39 East Hanover Ave., Morris Plains, NJ 07950

Please send books listed below:

Item No.	Qty.	Price Each	(P&H)	Total Price

Postage and handling charges appear in parentheses ( ) next to price of book.

Outside U.S.A. add $3.00 per order—shipped airmail only.

☐ ENCLOSED IS $_____. NJ residents add 5% sales tax.
☐ CHARGE MY: ☐ American Express ☐ Visa ☐ MasterCard

Card No._____ Exp. Date_____

Signature_____

Print Name_____

Address_____

City/State/Zip_____

☐ Check here for FREE Creative Computing Catalog.

For faster service, PHONE TOLL FREE: 800-631-8112
(In NJ only: 201-540-0445)
Please refer to Dept. 0000 when ordering.

8K ROM
16K RAM

Renumbering Basic Statements

Allen H. Wolach

Many versions of Basic have a Renumber utility. This is used to renumber Basic statements starting at a specified statement and spacing statements with a given increment between the statements. For example, if the starting number is 4 and the increment is 7, the lines in the Basic program would go: 4, 11, 18, 25, 32, etc. Most programmers start their programs at statement 10 and use increments of 10.

The advantages to a Renumber utility should be readily apparent. Sometimes a programmer uses all of the numbers between two Basic statements while modifying a program. A Renumber utility can be used to place unused statement numbers between all statements. A completed program is also more attractive if all of the statements are spaced at constant increments.

A Sinclair Basic Renumber Program

This article presents two Basic renumbering programs in Sinclair Basic for the 8K ROM. The program in Program 1 is a short program that can be used with 1K or 16K RAM. This program only renumbers the Basic statements. It does not do anything about the destination addresses for GOSUB and GOTO keywords that must be changed after a program is renumbered.

The program in Program 2 is a longer program that also calculates the destination address for each GOTO and GOSUB statement.

How to Use the Program

The user must select one of the two programs and enter it on a cassette tape. Whenever the user decides to work on a new program, he first enters the renumber program into his computer. During the stages of program development the renumber program can be saved on cassette along with the user's program. The renumber programs occupy consecutive high statement numbers (9981 through 9999 for Program 1 and 9938 for Program 2). This leaves almost all possible Basic statement numbers for the program that is being developed.

The variables in the renumber program were selected so that it would be very unlikely that the user would have the same variable names in the program that he is developing.

When the programmer decides to renumber the program, he enters GOTO 9982 (shorter program) or GOTO 9939 (longer program). Both programs prompt the user for the new starting statement of the user program and the increment between Basic statements. The user can choose any number from 1 to 255 for the starting number and for the increment between statements. After these numbers are entered, both programs renumber the user's program. If the longer renumber program is used, the program prints out a series of statements such as

```
25 GOTO 50
30 GOSUB 5
40 GOTO *
```

The user must edit statement 25 in the renumbered program so that the number after GOTO is changed to 50. Statement 30 must be edited so that 5 occurs after the GOSUB. The * in statement 40 indicates that the GOTO in statement 40 was not followed by a number or that the original number did not start immediately after the GOTO. Note that the renumber program is written so that it does not get renumbered while the users program is renumbered. In fact, any statement number above 8959 will not be renumbered.

After a program is completed and renumbered, the renumber program can be deleted statement by statement. Once the renumber program is deleted, a modified program cannot be renumbered by the renumber program unless the user is willing to reinsert the renumber program by hand.

Allen H. Wolach, Department of Psychology, Illinois Institute of Technology, Chicago, IL 60616.

How Program 1 Works

Sinclair computers with the 8K ROM start storing Basic statements at memory location 16509. Each stored statement starts with two bytes that contain the number of the Basic statement. The first of these two bytes, byte 16509 for the first Basic statement, contains the low portion of the statement number. Suppose that one has a Basic program in the computer. The command

PRINT PEEK 16509*256+PEEK 16510

would print the decimal equivalent of the first statement number.

The second two bytes in a program statement, 16511 and 16512 for the first program statement, contain a number that is the length of the Basic statement including the ENTER that occurred at the end of the statement. These two bytes have the high portion of the number in the higher byte (16512 for the first Basic statement) and the lower portion of the number in the lower byte (16511 for the first Basic statement).

Suppose that the variable III contains the address of the first (high) byte of a Basic statement (e.g., 16509). Location

Program 1. Renumber (1K).

```
9981 STOP
9982 LET JJJ=0
9983 PRINT "ENTER STARTING NUMBE
R"
9984 INPUT GGG
9985 PRINT "ENTER INCREMENT"
9986 INPUT FFF
9987 LET III=16509
9988 GOSUB 9991
9989 LET III=III+PEEK (III+2)+PE
EK (III+3)*256+4
9990 GOTO 9988
9991 IF PEEK II6>34 THEN STOP
9992 IF GGG<256 THEN GOTO 9995
9993 LET JJJ=JJJ+1
9994 LET GGG=GGG-256
9995 POKE III,JJJ
9996 POKE (III+1),GGG
9997 LET GGG=GGG+FFF
9998 RETURN
9999 STOP
```

III = 1 contains the second byte of the statement number. Numbers III = 2 and III = 3 are equal to the locations of the low and high bytes of the number of bytes in the statement. If III is set to the location of the high byte of a statement number, the high byte of the next statement number has to be

PEEK (III+2)+PEEK (III+3)*256+4

That is,

PEEK (III+2)+PEEK (III+3)*256

is equal to the length of the current Basic statement including ENTER. The 4 is the sum of the two bytes occupied by the statement number and the two bytes that indicate the statement length. The statement

LET III=III+PEEK(III+2)+PEEK (III+3)*256+4

can be used to increment III to the address of the first byte of the statement

New!

AIR TRAFFIC CONTROL
Cassette software for your 16K ZX81 or TS1000

Meet the challenge of up to 24 aircraft speeding across your screen to 5 different destinations!

No "safe" altitudes - every plane is your responsibility. You must identify type, heading and altitude and skillfully guide them through crowded airspace, while a real-time clock builds the pressure.

Every game is different.
Aircraft, ranging from a Cessna 152 to the new Boeing 767, enter your airspace whether you are ready or not.

Over 3K of machine code means immediate response. Experience the tension as you race to avoid the controller's nightmare - a mid-air collision!

Order **AIR TRAFFIC CONTROL** from:
Powerplay Systems
P.O. Box 752, Woodside
New York, NY 11377

Send $12.95 plus $1.50 s&h (NY res. add sales tax).
Allow 3-4 weeks for delivery.

For ZX80/ZX81 with 8K ROM and 16K RAM

Bon mot

AN ANAGRAM-, CROSSWORD-TYPE GAME, 1 to 6 PLAYERS

- *In home or classroom BON MOT makes learning fun and fun educational.*
- *Develops vocabulary and spelling skills*
- *Choose from 11 different sized "game boards" to control the length of each game*
- *Competitors' challenges cause players to use a dictionary for verifications and definitions*
- *Rules and playing tips on reverse side of cassette*
- *An exciting game requiring more than finger dexterity*

Only $9.99 each. 5 or more only $7.00 each.

(Pennsylvania customers add 6% Sales Tax. If mailed outside the United States please add 10% for shipping.)

Send check and order to:

GOTWALD, Box 404, DAVIDSVILLE, PA 15928

Please send ____ copies of BON MOT to:

Name_____

Address_____

LOAD EASIER

THE MICROCOMPUTER USER'S BOOK OF TAPE RECORDING ($5.80),

a comprehensive, easy-to-use mine of information on how to solve tape problems.

TEST AND ALIGNMENT CASSETTE ($9.80),

which has test signals and instructions on how to set up your recorder's head, and how to check the speed.

THE HILDERBAY LOADING AID ($11.90),

a simple-to-use device which lets you get the volume setting right first time: if a tape will load at all, you will be able to load it first time.

Send check or International Money Order to:

Hilderbay Ltd.
8/10 Parkway
Regents Park
London NW1 7AA
U.K.

Name _____

Address _____

City _____

State/Zip _____

number of the next Basic statement.

Suppose that one has a decimal number that is less than 255. This number can be added to the low byte of a statement number. The computer contains a number between 0 and 255 in this byte. If the sum of these numbers is greater than 255, a 1 must be added to the high byte of the statement number. Statements 9991 through 9998 in Program 1 are a subroutine that adds the increment (interval between Basic statements) to what was the number of the last renumbered statement. Assume GGG contains the new statement number for a statement that is being renumbered. Statement 9992 tests to determine if the number is less than 256. If it is less than 256, control passes to statement 9955 which pokes 0 into the high byte of the statement number because JJJ was set to 0 in statement 9982. Then statement 9996 pokes the new statement number in the low byte of the statement number in GGG by the appropriate increment, FFF. Then the main program is reentered (statement 9998) as statement 9984.

If the current statement number is greater than 256, JJJ, the high byte of the statement number, is corrected in statement 9994. That is, the low byte of the statement must have 256 subtracted to account for the 1 that was added to the high byte. Statements 9995 and 9996 POKE in the new high and low bytes for the statement number. Statement 9997 increments the statement number and statement 9998 returns control to the main program.

Statements 9983 through 9986 in Program 1 request and input the starting number and increment for the renumber program. Statement 9987 sets III to the address of the high byte of the first statement number. Statement 9998 transfers control to the subroutine that POKEs in the new statement number. When the main program is later reentered, statement 9989 increments III to the address of the high byte of the next statement number.

Statement 9988 returns the program to statement 9988 so that the next statement can be renumbered. Every time the subroutine for incrementing the statement number is entered, statement 9991 checks to determine if the current high byte of a statement number is greater than 34. If this number is greater than 34, the program stops, insuring that the renumber program will not be renumbered.

How Program 2 Works

Statements 9940 through 9944 request and input the starting number, GGG, and the increment, FFF. Statements 9944 through 9946 provide a heading for the GOTO and GOSUB statements that will be listed. Variable III is set to 16513, the beginning of the first Basic statement, in statement 9947.

Statement 9948 determines if one has reached the end of a Basic statement. The number 118 is the Sinclair code for the ENTER that terminates each Basic statement. If the end of a statement has not been reached, statements 9952 and 9953 determine if III is pointing to a GOTO (236) or a GOSUB (237) code. The variable HHH is set to 1 for a GOTO or 2 for a GOSUB code in statements 9952 and 9953. The variable HHH remains a 0 (set in statement 9939) if III is not pointing to a GOTO or a GOSUB code.

Statement 9954 checks to determine if III is set to the code (126) that indicates a five byte binary number is to follow. If a binary number follows in the Basic program listing sequence, statement 9954 increments III to the address of the first byte after the binary number. That is, statement 9954 adds 5 to III and statement 9956 adds an additional 1 to make a total of 6. The binary number plus the 126 code takes a total of six bytes in the Basic statement. A binary number can contain 126, 236, or 237 in any or all of the five locations occupied by the binary number. These numbers must not be interpreted as a GOTO, GOSUB, or the beginning of a number code.

Statement 9955 transfers control to statement 9958 if a GOTO or GOSUB code is encountered. If a GOTO or GOSUB code is not reached, III is incremented by 1 to the next byte (statement 9956) and control is returned to statement 9948 to check the next memory location. When an ENTER code is finally detected in statement 9948, the next byte in the Basic sequence is checked (statement 9949) to determine if the last program statement is renumbered. That is, III is set to the first byte of a statement number. If this byte is greater than 34, the statement number is above 8959 and is not renumbered.

Statement 9950 increments MMM which was set equal to the starting number for the Basic program in statement 9942. Every time statement 9950 is encountered, MMM is incremented by FFF which contains the increment number for the renumber program. Since statements 9948 and 9949 are only encountered when III is set to the address of ENTER (118) at the end of a statement, statement 9951 is used to increment III to the next Basic keyword. That is, the next statement number address and the two bytes containing the length of the next Basic statement are skipped.

Statement 9958 prints out the renumbered statement number of a GOTO or GOSUB statement. The word GOTO (statement 9959) or the word GOSUB (statement 9960) is printed by statement 9958 or statement 9959. Remember that HHH is 1 for a GOTO statement 9961. Statements 9958 through 9961 cannot be encountered unless III points to the address of a GOTO or a GOSUB code in the Basic statement.

The numbers that a user enters after a GOTO or GOSUB keyword are coded by the Sinclair ROM as a number between 28 and 37. That is, 0 is 28, 1 is 29 . . . 9 is 37. A GOTO or GOSUB code need not be followed by a number. An expression such as (A * B) could have been entered after the GOTO or GOSUB. Statement 9962 checks to determine if a number follows the GOTO or GOSUB code. If a number does not follow the GOTO or GOSUB code, an

Program 2. Renumber with GOTO and GOSUB Destinations.

```
9938 STOP
9939 LET HHH=0
9940 PRINT "ENTER STARTING NUMBE
R"
9941 INPUT GGG
9942 LET MMM=GGG
9943 PRINT "ENTER INCREMENT"
9944 INPUT FFF
9945 PRINT "REINSERT THESE STATE
MENTS"
9946 PRINT
9947 LET III=16513
9948 IF PEEK III<>118 THEN GOTO
9952
9949 IF PEEK (III+1)>34 THEN GOT
O 9986
9950 LET MMM=MMM+FFF
9951 LET III=III+5
9952 IF PEEK III=236 THEN LET HH
H=1
9953 IF PEEK III=237 THEN LET HH
H=2
9954 IF PEEK III=126 THEN LET II
I=III+5
9955 IF HHH>0 THEN GOSUB 9958
9956 LET III=III+1
9957 GOTO 9948
9958 PRINT MMM;
9959 IF HHH=1 THEN PRINT " GOTO
";
9960 IF HHH=2 THEN PRINT " GOSUB
";
9961 LET HHH=0
9962 IF PEEK (III+1)>27 AND PEEK
 (III+1)<38 THEN GOTO 9965
9963 PRINT " * "
9964 RETURN
9965 LET JJJ=2
9966 IF PEEK (III+JJJ)=126 THEN
GOTO 9970
9967 LET JJJ=JJJ+1
9968 IF JJJ>5 THEN GOTO 9963
9969 GOTO 9966
9970 LET LLL=1
9971 LET KKK=0
9972 LET KKK=KKK+(PEEK (III+JJJ-
1)-28)*LLL
9973 LET JJJ=JJJ-1
9974 IF PEEK (III+JJJ-1)=236 OR
PEEK (III+JJJ-1)=237 THEN GOTO 9
977
9975 LET LLL=LLL*10
9976 GOTO 9972
9977 LET JJJ=16509
9978 LET NNN=0
9979 IF PEEK JJJ*256+PEEK (JJJ+1
)>=KKK THEN GOTO 9983
9980 LET NNN=NNN+1
9981 LET JJJ=JJJ+PEEK (JJJ+2)+PE
EK (JJJ+3)*256+4
9982 GOTO 9979
9983 LET KKK=GGG+NNN*FFF
9984 PRINT KKK
9985 RETURN
9986 LET JJJ=0
9987 LET III=16509
9988 GOSUB 9991
9989 LET III=III+PEEK (III+2)+PE
EK (III+3)*256+4
9990 GOTO 9988
9991 IF PEEK III>34 THEN STOP
9992 IF GGG<256 THEN GOTO 9995
9993 LET JJJ=JJJ+1
9994 LET GGG=GGG-256
9995 POKE III,JJJ
9996 POKE (III+1),GGG
9997 LET GGG=GGG+FFF
9998 RETURN
9999 STOP
```

Peak

Cassette Software for the ZX81
and the Timex/Sinclair 1000

DATAPLOT

A program to plot free formatted data stored in REM statements. Draws and lables the axes, titles your plot and connects your data points. DATAPLOT will also draw figures, plot from an equation, and plot on a grid if necessary. Plot stock and metal prices, interest rates, scientific data, etc. with this versatile program. $10 16K

TEXT and PRODIR

Our most popular program set. TEXT - A program for easy text editing, storage and display. Recall pages of reports, letters, etc. without splitting words at the end of a line. PRODIR - A programed directory to organize programs and ease loading. $10 16K

BLACKJACK

Practice your strategy. Hit, stand, double down, split, and take insurance with this Nevada casino game. Deals out a complete deck before shuffling. $10 16K

MATHFUN

First grade math with creative graphics to help your children learn and review while having fun. Five 2K programs covering addition, subtraction, time telling and more. Developed by a certified teacher. $20 2K Watch for our complete educational software line to be out soon.

$1 discount if you order 2 program sets and request them to be put on one tape. Prices include shipping.

Send check to our new location:

Peak P.O. Box 8005 Suite 231,
Boulder, CO 80306-8005

KEYBOARDS

YOU NEED A FULL-SIZED KEYBOARD, BUT WHY PAY MORE?

This a new, FULL-STROKE, 53 KEY, surplus, GOLD-CONTACT keyboard, originally made for a Texas Instruments computer terminal. Comes with 6 inch space bar, 2 oversized shift keys, an oversized return (enter) key and 12 spare keys which can be used for the special circuits described below. An optional parts kit is available with all the electronic parts required. (IC's with sockets, resistors, capacitors, LEDs, etc.) You provide only, wire solder and a small piece of perf-board for assembly.

The keyboard comes FULLY ASSEMBLED and ready to connect to your computer via a 13 conductor ribbon cable (supplied). The expansion connector is left free for your use with printer, RAM, or other devices.
The keyboard comes with full plans for the following circuits:

ELECTRONIC SHIFT-LOCK WITH LED INDICATOR.
AUTO-REPEAT WITH LED INDICATOR. Once activated this circuit will allow you to continuously input any key just by holding it down. Includes variable speed control.
AUTO-SHIFT FOR SELECTED FUNCTIONS. You decide which shifted functions (like $ = + comma delete etc.) you will place on dedicated keys, to be used WITHOUT SHIFTING. The parts kit contains enough parts to dedicate 10 keys.

$A60.00 COMPLETELY ASSEMBLED KEYBOARD & CIRCUIT PLANS
Shipping/handling/insurance - add the following:
US,APO,FPO-$3, CANADA-$4, OTHER FOREIGN-$12
Texas residents please add $2.53, state sales tax.

FOR PARTS KIT ADD $13 & AN ADDITIONAL $1 FOR POSTAGE
Texas residents please add $.72, state sales tax.

SYNC SUBSCRIBERS INCLUDE MAILING LABEL FROM COVER AND DEDUCT $3

DOUBLE H ELECTRONICS
195 LELANI
SAN ANTONIO, TX 78242

Only U.S. DOLLARS CAN BE ACCEPTED. MONEY ORDERS PREFERRED. PERSONAL CHECKS MUST CLEAR BEFORE SHIPMENT.

PREMIUM CASSETTES

COMPUTER GRADE
100% ERROR-FREE
FULLY GUARANTEED

MANUFACTURER PRICES

The Micro-Trac™ Generation

- High Frequency Response
- Wide Dynamic Range
- *Used by Software Firms & Computer Hobbyists*
- Choice of School Districts Nationwide

LENGTH	12-PAK	24-PAK
C-05	$ .69	$ .59
C-10	$ .79	$ .69
C-20	$ .99	$ .89
C-30	$1.19	$1.09
C-60	$1.49	$1.39
C-90	$1.79	$1.69
*CASES	$ .21	$ .20

*Cases recommended to protect sensitive cassettes.

—UPS SHIPPING—
(No P.O. Boxes please)
$2.00 (12-pak) $3.00 (24-pak)
—Canadian shipping multiply by 2—

#1 COMPUTER TAPE IN THE USA!

—write for volume prices—

VISA

master charge

TOLL-FREE
(orders only)
1-800-528-6050
ext. 3005
In Arizona
1-800-352-0458
ext. 3005

MICRO-80 ™ INC.

2665 Buzby Road
Oak Harbor, WA 98277
—Distributors Wanted—

ABERSOFT

7 MAESAFALLEN, BOW ST, DYFED, SY24 5BA

ZX81 & Spectrum Games

Now NEW LOW prices!!!!

PROGRAM	PRICE
Chess 1.4 10 levels m/c	$17.95
Adventure 140 locations based on the original	$17.95
Invaders Fast m/c arcade action	$8.95
Mazeman All the features of the original arcade version m/c	$8.95

Add $2.00 for postage/handling

PROGRAMS WANTED

Do you have a program for the SINCLAIR ZX81 or TIMEX 1000?

MEMORY MASTER is now seeking new programs to add to our software line.

If you have a quality program, suitable for sale in **retail** stores, we are interested.

Royalties paid for programs we market.

Send name, address, phone and description of program to:

Memory Master
P.O. Box 774
Barnegat, N.J. 08005

Dealer inquiries welcome.

NEW STATE OF THE ART TS1000/ZX81 (16K) SOFTWARE

ENTIRELY MACHINE CODED

3D SPACE BATTLE. Incredible, super fast and complex 3D graphics. You are in the starfighter cockpit and the screen is your window over an unlimited Universe background. You see the Alien Starfighters coming and firing their Photon Beams to you. Destroy as many as you can with your Laser Gun while you have energy. See the Explosions, Laser Beams, Photon Beams, Alien Starfighters, all in full 3D. Full 8 direction control with just 3 keys.

LUNAR LANDER. The first real simulation of the well known arcade game for the TX1000/ZX81 computers. Two stages of resolution. Smooth motion of the Lunar Module. Selectable levels of gravity and inertia. Full graphics.

SUPER-ZXCLOCK. Giant display up to 10nths of second. Mini-display up to 100nths of second. 10 chronometers. Musical alarm.

ORCHESTRA. The computer plays your favourite melodies without add-ons. You don't need to know how to play any instrument: just enter a sequence of note names and durations. Stores up to 3000 note melodies on tape. Full editing capabilities. User re-definable music notation. Perfectly tuned on A440. Allows sound over 3 octaves, with semitones and rests. Sounds through the TV speaker or an amplifier connected to the MIC output of the computer. Uses BASIC to set-up and edit sequence.

ONLY $14.95 EACH (INCLUDING AIRMAIL). SEND CASH, CHEQUE OR MONEY ORDER PAYABLE TO JOSEPH-ORIOL TOMAS. VISA & M/C ACCEPTED. PLEASE ALLOW UP TO 28 DAYS FOR DELIVERY. SPANISH VERSIONS ALSO AVAILABLE.

ATTENTION ZX SUPPLIERS: WE ARE INTERESTED IN ACQUIRING LICENSING RIGHTS TO TRANSLATE & MARKET YOUR ZX SOFTWARE IN SPAIN (THIS IS ALSO THE BEST WAY TO PROTECT YOUR COPYRIGHT). WE ARE ALSO THE MAIN DISTRIBUTORS OF ZX HARDWARE AND BOOKS IN SPAIN. SAMPLES WELCOME.

WE ARE ALSO LOOKING FOR SOMEONE TO PRODUCE OUR SOFTWARE IN U.S.A. UNDER LICENSE AGREEMENT. SEND YOUR OFFER.

Joseph-Oriol Tomas, Director
VENTAMATIC Micro-Informática
Avda. de Rhode, nº 253
ROSES (Girona)
SPAIN

NEW

From Intercomputer
A
Full Line
of
Software
for your ZX81 or
Timex Sinclair 1000

Please send me a FREE
Program and Catalog

Name _____

Address _____

_____

_____

Send this coupon to:
Intercomputer
Box 90
Prudential Center
Boston, MA 02199

asterisk (statement 9963) is placed after the statement number and GOTO or GOSUB that are on the screen. Then control is returned to statement 9956 so that III can be incremented to the next location in the Basic sequence.

If a number is located after GOTO or GOSUB, statement 9962 causes statement 9965 to be encountered. Statements 9965 through 9968 start JJJ at 2 and increment JJJ as successive memory addresses are checked to determine the length of the number. If the number is greater than 4, statement 9968 transfers control to statement 9963 to print an asterisk after the GOTO or GOSUB on the television screen. The program assumes a valid number following a GOTO or GOSUB cannot be greater than 4 bytes long.

After statement 9966 detects a byte containing 126 (the beginning of a binary number), control is transferred to statement 9970. At this point III + JJJ points to the location after the number in the GOTO or GOSUB sequence. Statements 9970 and 9971 set LLL and KKK to 1 and 0, respectively.

Statements 9972 through 9976 form a loop that changes the coded number of following GOTO or GOSUB into a decimal number. The loop starts (statement 9972) by examining the last coded digit in the number, and subtracting 28 from this coded number to make it into a decimal number. The number is multiplied by LLL which is started at 1. The variable JJJ is decremented by 1 in statement 9973.

If the number was only one digit long or a 236 (GOTO) or 237 (GOSUB) code is detected in statement 9974, control is transferred to statement 9977. If the number is more than one digit long, the multiplier LLL is multiplied by 10 and statement 9976 transfers control to statement 9974. Statement 9974 decodes the second from the last digit of the number, multiplies it by LLL, which is now 10, and adds this number to the last digit of the number. The loop in statements 9972 through 9975 is not completed until the entire number is decoded.

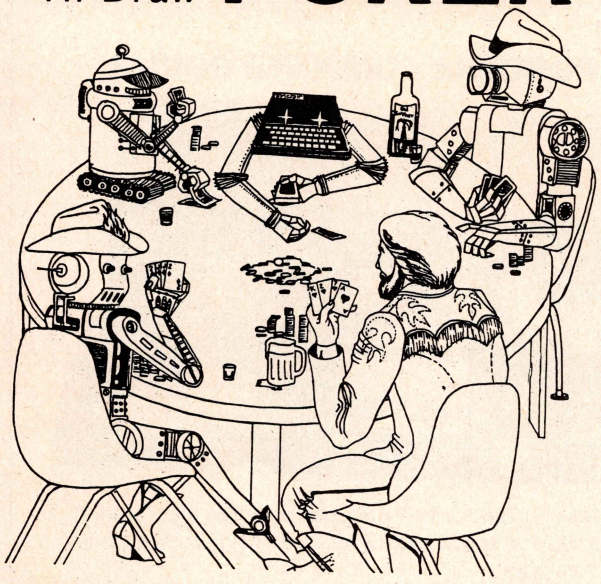
Statement 9997 sets JJJ to 16509, the starting address of the Basic statements. The loop in statements 9979 through 9982 looks at each Basic statement address and checks to determine if the address is greater than or equal to KKK which is the decoded old address of the current GOTO or GOSUB statement. After an address is checked, 1 is added to the variable NNN.

When an address is encountered that is greater than KKK, NNN contains a number that equals the number of Basic statements before the statement that is the destination of the GOTO or GOSUB statement.

Statement 9983 uses this formula: New destination address = New starting address + (number of Basic statements before the destination statement - 1) * increment. This is used to calculate the new destination address for the GOTO or GOSUB statement in question. Statement 9984 prints the new destination address after the GOTO or

Finally, statement 9985 returns control to statement 9956 to repeat the process outlined above for the next Basic statement. When the last GOTO or GOSUB statement is listed, statement 9949 transfers control to statement9986. Up to this point the original program has not been renumbered. Statements 9989 through 9998 renumber the program in the same way that statements were renumbered in Program 1. In fact, statements 9987 through 9998 in Program 2 are identical to the statements with the same statement numbers in Program 1. ■

No-Limit Hi-Draw **POKER**



Challenge any 5 (6-handed) of ten opponents; each plays differently.

ZX81/TS1000 (16K) ZXP12C (Cassette).. **$16.95**
Postage & Handling.. ...$1.50 N.Y. Residents, add 7% sales tax

Basically Software Company
P.O. BOX 2977 • SYRACUSE, NEW YORK 13220

ROM
DISASSEMBLED

ZX-81 TIMEX-1000

8K ROM DISASSEMBLY LISTING...OVER 100 PAGES !!!

This is not a manual or textbook...
But much more than just a 'raw' disassembly.

All major BASIC command routines (e.g. FAST,SCROLL,CLS) are LABELLED and CROSS-REFERENCED. We've added helpful comments in many cases.

With this text as a reference you will be able to :

* Reduce program length and RAM requirements by USR calls to ROM routines
* Add machine code speed to your graphics without re-inventing the wheel for every routine
* Load programs faster since the ROM routines are available at power-up
* Work around, or with, the 'peculiarities' of the ZX-81...Display handling...Variables...Interrupts

Send $19.95 plus $2.00 postage to:

D A DATASYSTEMS
229 Ravenwood Ave. Rochester, NY 14619
716-328-3661

YORK 10
BASF-DPS
WORLD STANDARD TAPE

MONEY BACK GUARANTEE

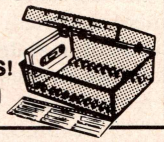
PREMIUM 5-SCREW SHELL FITS ALL STANDARD RECORDERS

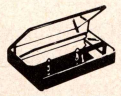
COMPUTER GRADE BLANK CASSETTES

DATA TRAC / C-05, C-10, C-20

CASSETTE STORAGE CADDY

NEW! ORGANIZE YOUR TAPES! $2.95 EACH





FINEST QUALITY PHILIPS (NORELCO) TYPE HARD BOXES

TRACTOR FEED DIE-CUT BLANK CASSETTE LABELS

INTRODUCTORY OFFER!

ORDER 2 DOZ. CASSETTES, ORDER 1 CADDY GET 1 CADDY FREE! ORDER 4 DOZ. CASSETTES AND 2 CADDIES — GET 2 FREE

HERE'S WHAT USERS SAY ABOUT YORK 10 CASSETTES:

"We monitored the output to the computer with a specially built meter and found absolutely no dropouts throughout the tape . . ."
Stace Papadopoulos
Beaverton, OR

"It's nice to have a tape you can rely on 100% of the time to perform with such quality. And the fast, courteous service was a pleasant surprise."
Tom Parkinson
Madison, OH

"YOU'VE TRIED THE REST, NOW BUY THE BEST"

VISA **Call: 213/710-1430** for IMMEDIATE SHIPMENT on Credit Card Orders. MasterCard

ORDER NOW . . . **YORK 10 Computerware**
MAIL TO: 24573 Kittridge St., #A 3, Canoga Park, CA 91307

ORDER FORM

ITEM	1 DOZEN	2 DOZEN	TOTAL
C-05	☐ 7.50	☐ 13.50	
C-10	☐ 8.00	☐ 14.40	
C-20	☐ 10.00	☐ 18.00	
Hard Box	☐ 2.50	☐ 4.00	
Storage Caddy @ $2.95 ea.: Quantity:_____ FREE: Quantity:_____			
Blank labels	☐ 4.00/100	☐ 30.00/1000	
		SUB TOTAL	
Calif. residents add 6% sales tax			
Shipping/handling 1 doz. $2; 2 doz. $3.50; 3 doz. $4.50; each additional doz. $.50.			
For Parcel Post instead of UPS ADD $1			
Outside Continental USA, ADD $2			
		TOTAL	

Each cassette includes two YORK 10 labels only. Boxes are sold separately. Shipments are by U.P.S. unless Parcel Post requested. Boxes, caddies, and blank labels are free of shipping charges when ordered with cassettes. When ordered without cassettes, shipping charges: Boxes—$1.00/doz.; Caddies $1.00 each. MINIMUM SHIPPING/HANDLING ON ANY ORDER—$2.00.

Check or M.O. enclosed ☐ Charge to Credit Card: ☐ VISA ☐ MASTERCARD

☐ PLEASE SEND QUANTITY DISCOUNTS

Card No. _____ Exp. _____

Name _____

Address _____

City _____ State/Zip _____

Signature _____

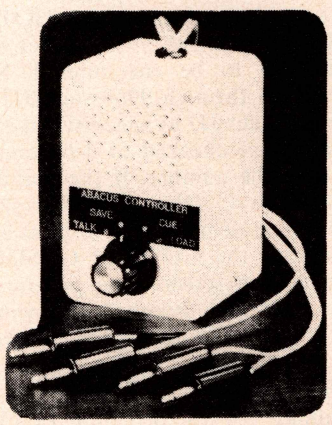
Computer make & model _____ Disk?(y/n)_____

If you own a ZX81 or a TIMEX 1000 then you need the ABACUS CONTROLLER

Developed to eliminate tedious swapping of plugs when LOADING or SAVING programs on cassette.

One switch operation allows selection of TALK, SAVE, CUE and LOAD modes. Using a built-in microphone/speaker to allow fast and reliable program naming and cueing.

Price $24.95 inc.



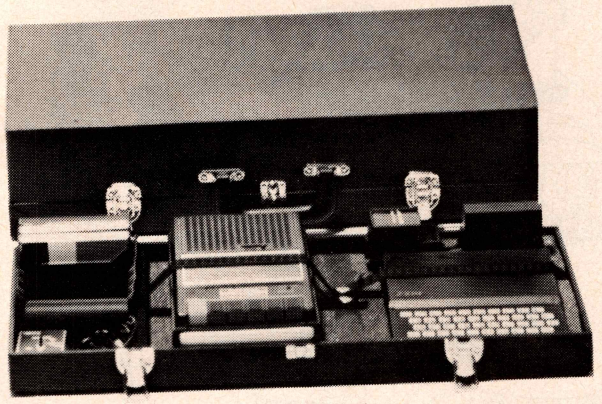
Now available - AVENGER - an Arcade style, machine code game for the 16k ZX81 written by the **real** Kevin Flynn. Guaranteed the best there is.
Price $9.95 inc.

MasterCard

abacus electronics

186 St. Helens Avenue
Swansea. West Glam.
Great Britain
tel: 0792 50282

PORTABLE COMPUTER POWER



Protect your Sinclair in a portable, dust free work station.
Extra storage space for 6 tapes, connecting cables, power and ram pack.
Removable lid allows in-case operation.
Non-skid feet prevent desk top scratches.
Absolutely the most efficient and convenient way to protect, store, and transport your computer system.
Only $54.95 in continental U.S.A.

Dealer Inquiries Welcome

CASES INC. P.O. Box 33820 Seattle, WA 98133 (206) 365-5210
VISA MASTERCARD

Your Timex/Sinclair Can Become a Terminal

V. B. Rice

Introduction

The number and variety of "on-line" computer services is growing rapidly. Users can access vast data bases of news services, stock exchange market data, weather information, agricultural assistance, and whatever else the service providers can dream up. In addition to public services, private groups such as local computer clubs are beginning to use data transmission to distribute their bulletins and programs. The user can even dial up original computing services.

All that is required to be able to avail yourself of such services is a terminal, a telephone, and a modem—the means of connecting the two.

A terminal is essentially a device with which a human being and a computer communicate. It can be "hardcopy" (a teletype or typewriter like device) or a "CRT" (using a TV type screen). In either case a keyboard or some other means of inputting data is necessary. A typical CRT terminal costs in the area of $1,500, with the hardcopy terminals usually being a little more, due to their mechanical complexity.

The Sinclair is a prime example of the CRT terminal: it has a keyboard (although somewhat quaint) plus the TV as a display unit. Thus it is not surprising that ZX81 and T/S 1000 users are interested in using their computers as terminals for the larger mainframe computers. The only thing lacking is the means of connecting the computer to the telephone.

The user must have a modem to form the interface between the terminal and the public telephone system. Since most telephone companies view with grave concern the idea of anyone attempting to send electrical signals through their lines and relays, the modem performs the function of translating the electrical impulses from the terminal into audible tones acceptable to the normal telephone lines through which we speak to each other. At the receiving end of the telephone circuit, another modem accepts the tones from the telephone speaker and converts them back into electric signals compatible with the receiving computer. The tone generating and recognition capabilities of this device resulted in its rather strange name which is a contraction of frequency MOdulator/DEModulator. A modem costs, in Canada, anywhere from $250 (Radio Shack) up to well over $1,000, depending on the speed with which it can transmit and receive data.

V. B. Rice, 119 Exeter Rd., Ajax, Ontario, Canada, L1S 2K4.

An Interface Board

It would be very pleasant if the ZX81 could merely be attached to a modem and be magically transformed into a terminal. Unfortunately, this is not directly possible. You must have a device to connect a typical modem and your Sinclair called an Interface Board. Fortunately, you can build such a board because it is a reasonably simple circuit to wire up. If you have had any experience working with IC's (Integrated Circuits), you could build one easily in a weekend, with time off for sleeping. With no experience (my case), you should be able to have it operational in a week of working evenings. The cost should be in the range of $25 to $50 (Canadian), depending on how much shopping around you are willing to do for the parts.

Although I designed and tested this interface board on a ZX81, it should work on the ZX80 also. However, the Basic interpreter will not be able to keep up with the line speed when receiving data because of the lack of a "FAST" mode on that model. The speed problem can be eliminated by the use of machine code programming for that routine. From the little information I have been able to glean on the new Sinclair Spectrum computer, this board will probably operate on that machine also.

As an added bonus, this interface board will also allow the Sinclair to communicate with a terminal as well, or with an RS-232 wired line printer.

I am grateful to David Sommers for his article "Experiments in Memory and I/O Expansion" (*SYNC* 1:6). This was of considerable help to me in my experiment. For those who are interested in pushing the usefulness of the Sinclair to extremes, an excellent book is *Interfacing Microcomputers to the Real World* by M. Sargent III and R. L. Shoemaker and published by Addison Wesley Publishing Company in the U.S.A.

Theory of Serial Data Transmission

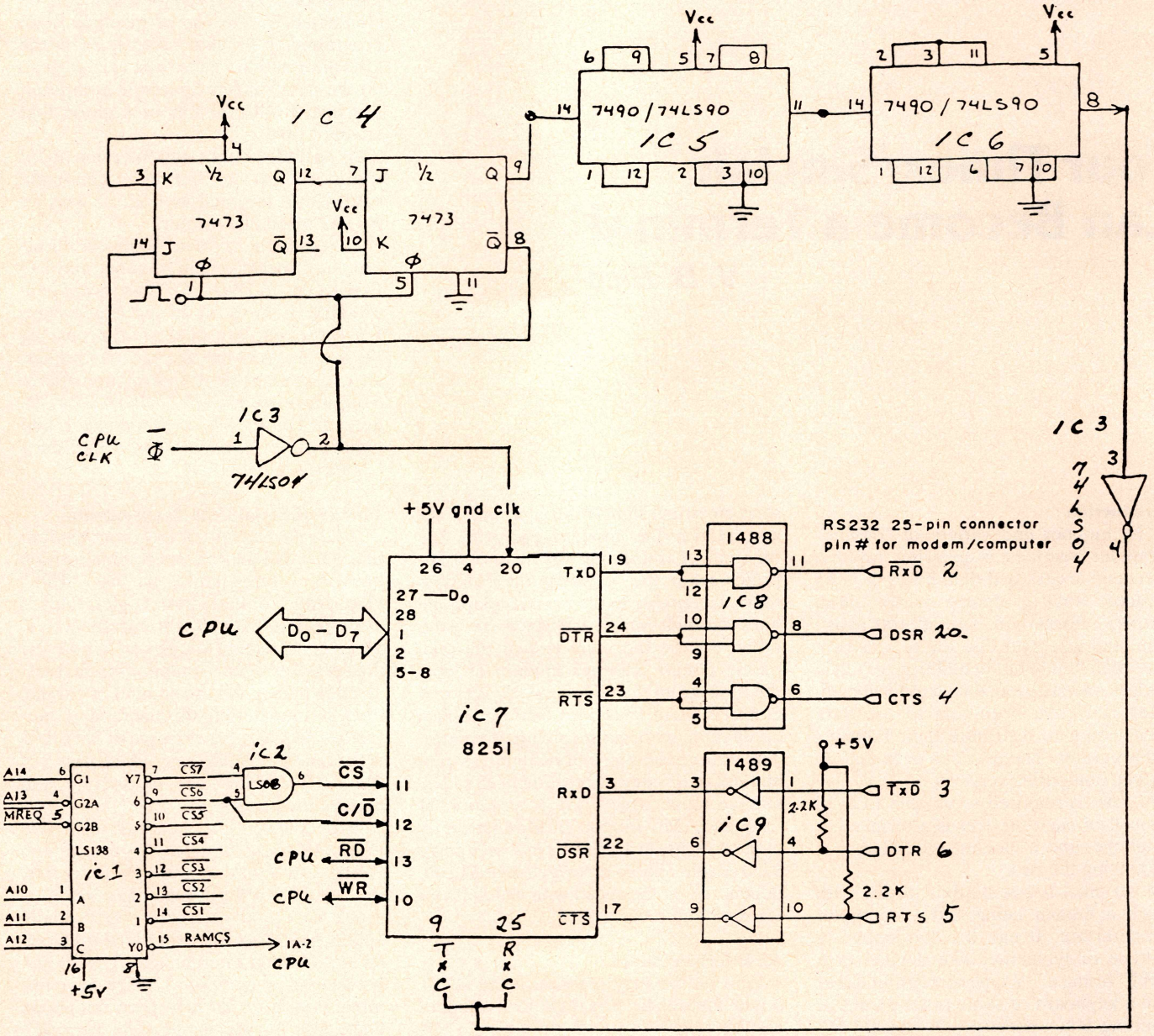
Inside the Sinclair, or any other modern micro for that matter, the communication between components is via "TTL" (Transistor to Transistor Logic). This is essentially a 0 volt/5 volt current fluctuation, of extremely low power. Where the distance between components is measured in inches and the number of parallel lines is immaterial, this method is perfectly adequate. An example of TTL I/O is the Sinclair ZX Printer, which uses 5 of the 8 CPY data lines to operate and control the printer.

This "convention" becomes unweildy when the distances involved grow, due to voltage attentuation through the wires, the number of lines, etc. The most generally accepted alternative is "serially coded ASCII" (American Standard Code for Information Interchange). This is used between most computers which have terminal interfaces for low-speed telephone lines, and by the public data networks such as DATAPAC in Canada, and TYMNET in the U.S.A.

This serial I/O involves breaking the data characters to be transmitted into individual bits, then shipping them down the line one bit at a time at a predetermined rate of speed. This allows the use of only one wire, since the data is "turned sideways," and the signals can then be amplified to allow greater distances between the sending and receiving devices.

This protocol requires that the sending and receiving parties must have agreed (electronically) on the transmission speed, which is known as the "BAUD" rate, or "Bits Per Second," the number of bits which represent a full character, and the number of check or parity bits (if any) that will be included with each full data

Figure 1.



character transmitted. Since it is difficult to change the computer at the other end, the user must know in advance what the receiving CPU expects and act accordingly.

Serial data output can be accomplished in a variety of ways: the Sinclair uses this form to "SAVE" files on cassette and to "LOAD" them back into core again. In this case the serialization is accomplished by software, loading each data character into a register and then shifting the bits off the end. If the shifted bit was a "1", a "one" sound is sent to the tape recorder; if the shifted bit was a "0", a "zero" sound is generated. The reverse process listens to the sounds from the tape recorder, and gathers the data bits together into bytes.

Transmission Speed and Noise

Transmitting data in this manner to other CPUs is perfectly feasible, but there are two problems. First, the programming required to match the transmission speed to the receiving CPU is extremely complex. This is where the major building block of this interface board comes into the picture.

The "USART" (Universal Synchronous/Asynchronous Receiver Transmitter) is a sophisticated chip which solves all these problems for you. You merely tell it the BAUD rate, the parity settings, and the character format to send or receive, and it does all the work. It will serialize the data you present and send the data out at the correct time intervals. When it is receiving, it will reconstruct the data characters and pass them out to you, along with any indications of errors. Great stuff!

Second, the problem of electronic "noise" on the line is addressed by the use of the "RS-232" interface chips. Instead of using the 0 to 5 volt TTL of the computer chips, the output and input to these chips is a negative and positive voltage: a "1" is -3 to -15 and a "0" 3 to 15 volts. Since the voltage is considerably higher, and the 0 and 1 value variations are considerably wider with a zero level crossing, there is much less possibility of interference and a far greater range capability.

ZX80/81 USER Beat the Program Loading Blues with a DATA CONDITIONER II

USE THE DATA CONDITIONER II to;

- Eliminate cable changing
- Allow accurate volume control setting for a perfect load every time.
- Allow for easy cueing of tapes
- Allow you to use the remote feature on your tape deck.

Order TODAY by phone using Visa, American Express, Master Charge, 24 hour toll FREE number 1-800-367-5134

order part number CSL-DS $49.95

address: **Communication System Laboratories**
94-165 Leokane Street
Waipahu, HI 96797

allow 3 weeks for delivery
add $3.50 for shipping & handling (air parcel post)
add $5.00 UPS Blue Label

EZRA GROUP II
EZRA GROUP II

LOW LOW LOW LOW LOW LOW LOW LOW LOW PRICES!

Biorhythms 8K ROM/1K&up.....1.00
Graphics Billboard 8/lup.....1.00
TAP WRITER TM(Handicap Aid)8/1.FREE
Horse Race 8/lup.....2.00
SPINNER TM(like Rubik's)8/16...2.00
Improved SLOW PAUSE.....1.00
Linear Regression 8/lup.....2.00
CHAR. Generator Demos 8/lup....2.95
Plotting Work Sheet 8/1.....3.95
Plotting Work Sheet SLOW/16....6.95
SPLIT-A-STACK TM SLOW/lup.....2.00
CHEWTER TM(like PACMN)SLOW/16..2.95
ISLAND SQUARES TM SLOW/2up.....2.00
Random MUSIC!SLOW/lup.....2.00
BASIC Keyword Demos 8/1....from .50

ORDER,SASE,reSASE gets you GOO-DIES Catalog and !!FREE!! Program

EZRA GROUP II
EZRA GROUP II

POB 5222 San Diego,California 92105

EZRA GROUP II
EZRA GROUP II

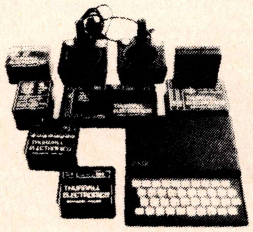
WE CHALLENGE THE SOFTWARE COMPANIES TO LOWER THEIR PRICES!

Biorhythms 8K ROM/1K&up.....1.00
Graphics Billboard 8/lup.....1.00
Horse Race 8/lup.....1.00
SPINNER TM(like Rubik's)8/16...2.00
Improved SLOW PAUSE.....1.00
Linear Regression 8/lup.....2.00
CHAR. Generator Demos 8/lup....2.95
SPLIT-A-STACK TM SLOW/lup.....2.00
CHEWTER TM(like PACMN)SLOW/lup.2.95
ISLAND SQUARES TM SLOW/2up.....2.00
Random MUSIC!SLOW/lup.....2.00
BASIC Keyword Demos 8/1....from .50

ORDER,SASE,reSASE gets you GOO-DIES Catalog and FREE Program

EZRA GROUP II
EZRA GROUP II

POB 5222 San Diego,California 92105



ZX81 OWNERS

SPECIALISED PRODUCTS MODULAR EASY TO USE FOR HOME/INDUSTRY & EDUCATION

TE10 INPUT/OUTPUT PORT – Easy to use. Fits between ZX & RAM PACK/PRINTER (if required). No skill required to connect. Can be used for such things as:– motor control; sound/music generators, connection to printers/floppy discs/light pens/other computers, temperature monitoring, square wave generating, control of rotating aerials, even train sets etc. Port has 16 programmable 1/0 lines and may be used without any electronics knowledge to connect other add-ons. Motherboard required ONLY when two or more add-ons are used at any one time.
FULLY ASSEMBLED **$29.50**
KIT (WITHOUT CASE) **$24.50**
TE12 4 CHANNEL RELAY BOX – To suit Port Contact rating:– 240v AC/1,5A – 24V DC or 110V AC/3A. Up to 4 units i.e. 16 relays can be operated **$24.50**
TE15 8 WAY TRANSISTOR DRIVER – **$16.50**
TE17 8 WAY SWITCH UNIT (EDUCATIONAL) – **$21.50**
TE18 8 WAY INDICATOR UNIT (EDUCATIONAL) – **$21.50**
TE20 JOYSTICK & FREE GAME – (2 Joysticks may be connected via Motherboard.) **$21.50**
TE30 MOTHERBOARD – Allows multiples combinations of add-ons – up to 16 1/0 lines may be used – **$26.50**
NOTE: TE 12/15/18 Require 9V. 300mA Calculator Type Power Supply
23 + 23 WAY ZX Edge Con **$5.00**
16 WAY SINGLE SIDED EDGE CON **$3.50** EXTENDED PIO NOTES **$2.50**
PRICES INCLUDE POSTAGE

Receipts always provided: – Delivery normally ex-stock. ADD Full instructions and examples with all products.
Send for catalog $1.00. Mastercharge/Visa accepted.
SEND S.A.E. FOR CATALOGUE. TELEPHONE ORDERS ACCEPTED.
DISTRIBUTOR INQUIRIES INVITED

VISA

THURNALL (ELECTRONICS) ENG.
DEPT Y, 95 LIVERPOOL ROAD.
CADISHEAD, MANCHESTER
M30-5BG ENGLAND
TEL: 061-775-4461 (24 hr)

The RS-232 standard also describes a special 25 pin "D" connector, with all 25 pins accounted for. In actual practice, only 4 pins are really necessary for terminal use, one each for data input and output, and two grounds. This convention also assigns a male connector (DB25-P) to the terminal (the Sinclair in this case), and a female connector (DB25-S) for the modem.

Circuit Overview

The heart of this circuit is the USART, in this case, the INTEL 8251. By tying this IC to the address decoding scheme provided by David Sommers, together with a clock dividing circuit, and an RS-232 transmit and receive pair, we have a workable interface board. I also followed his directions and added a few extra memory chips to buffer the incoming messages. This added another $30 to the cost of the board. Debugging the circuit took a fair bit of trial and error. The main problem was in the timing circuit.

The data clocking on the board is derived from the 3.25 MHz CPU clock used by the ZX81. (MegaHerz where 1 MHz 1/1,000 sec.) The circuit described in this article is wired to provide a 300 BAUD data rate, which is more or less standard for voice-grade telephone line communications and just about the maximum that can be handled by a program written in Sinclair Basic. I have experimented with the timing circuit and have run the BAUD rate up to 9,600 with no problems, but at that speed the control program has to be written in machine code to keep up with the incoming data.

Since the I/O circuit board is memory mapped, you can write your terminal programs in Basic; no machine language code is necessary unless you really want to get fancy. Initializing/resetting the USART is done by merely POKEing the required values to an address in core: sending a data byte by POKEing the ASCII value into another core address, and reading a byte by PEEKing at the same core location. These addresses are determined by the wiring in the circuit board. In this example they are locations 21508 for the 8251 control port and 22532 for the data port. Actually they will respond to any address up to 1K above these respective addresses. This poses no problem unless you have an expansion RAM pack. The results of running with the RAM pack attached will be unpredictable.

By using the CPU I/O control lines for chip selecting, the circuit can be I/O mapped instead of memory mapped. In this case IN and OUT machine code instructions will be required to operate the circuit. This will complicate the programming required to use it.

Circuit Components

Let's look at the major components shown in the circuit wiring diagram (Figure 1) with a short discussion of the purpose of each. The IC number from the diagram is followed by the IC type in parentheses. The actual manufacturer of the IC is immaterial, with the exception of the 8251 USART which is only made by Intel. All of the ICs in the circuit are readily available; most of them are stocked by Radio Shack.

a. IC1 (74LS138)

IC1 forms the address decoding circuit, with output control lines shown as Chip Select 1 through 7. I used CS6 for the control port and CS7 for the data port on the USART. CS1 through 5 can be used for 5K of onboard memory. Adding 2 more 74LS138s as per Sommer's article can increase the available address range up to 32K if required.

The inputs shown on the wiring diagram for this IC (A10-14, MREQ and RAMCS) are taken straight from the back of the CPU.

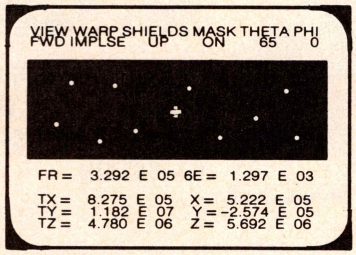
b. IC2 (74LS08)

IC2 is used for combining control lines.

c. IC3 (74LS04)

IC3 is required for inverting the signal

-81 SPACE RAIDERS™



ZX81

16K RAM

The federation has declared a state of all-out war, leaving you in charge of the Starship Defiant: newest and most advanced spacecraft known to man.

Soon, your experienced guidance will bring you within range of the enemy convoy. Hundreds of stars flash by as you check the status of your Laser, Shields, Masking Navigation, Scanning, and Computation Equipment. The energy drain is tremendous, as the target distance indicator ticks slowly downward . . .

As you come into range you set your cross-hairs on the nearest ship. Fire Laser!!! Switch to Aft view!!! Evasive Maneuvers!!! Space explodes all around you as the first enemy ship disintegrates and the remainder lock onto your position . . .

High speed graphics and custom ML math package provide the real time, accurate simulation of the above space navigation and battle scenario. You've never seen this kind of performance on your ZX81 before!

Only $19.95 for cassette, keyboard overlay, and manual (shipping included). (Utah residents add $.95 tax).

NIRAD ELECTRONICS

959 East 460 South
Provo, UT 84601

WANTED...

the non-exclusive rights to manufacture and sell your Timex/Sinclair educational and entertainment programs.

We will pay

CASH

DALLAS DEVELOPMENT SYSTEMS
7410 Stillwater
Garland, Texas 75042
(214) 238-1776

from the CPU clock. To minimize noise problems with this IC, tie all unused inputs high (i.e., connect pins 9, 11, and 13 to pin 14 which is 5 volts).

d. IC4 (74LS73)

e. IC5 and IC6 (74LS90)

ICs 4, 5, and 6 are cascaded together to produce the data clock required by IC7 (the 8251). The CPU clock is inverted by a 74LS04, then divided by 7 by IC5, then by 3 by IC4, and by 8 again by IC6. Using this scheme, the USART data clock can be tapped off either pin 11 of IC5 to give BAUD rates of 9,600 and 2,400, or pin 8 of IC6 (as shown) to give BAUD rates of 1,200 and 300. (The dual BAUD rate is program controllable).

The CPU clock (inverted) is tied straight on to the clock input for the USART. Although the specs for this chip specify a maximum clock rate of 2MHz, it works quite happily at the higher clock frequency.

f. IC7 (8251 USART)

This is the parallel to serial data I/O handling module.

g. IC8 (1488)

This is the RS-232 transmitter.

h. IC9 (1489)

This is the RS-232 receiver.

IC8 and IC9 are an RS-232 transmitter/receiver pair which are wired to the I/O pins of the 8251 to provide the actual interface to the outside world. The 1488 requires a +/-voltage set higher than the TTL 5 volts used by the rest, so be very careful about the wiring on this one. Although the RS-232 specs call for +/-15 volts, anything between +7 to +15, and -2.5 to -15 will work. My prototype board uses the 9 volt CPU power supply for the positive voltage and a square 9 volt battery for the negative. It is still working with that configuration. One battery lasts for about a month of rather heavy use.

Note that in Figure 1 the power supply pins are omitted for the 1488 and 1489. The 1489 power supply is 5 volts to pin 14. Both of these ICs require pin 7 to be connected to ground. The 1488 RS-232 higher voltage range is connected with +7 to +15 volts on pin 14, and -2.5 to -15 volts on pin 1.

i. 1 DB25-P connector

This is used to attach the Sinclair to your modem.

j. 1 socket of 1/10 inch spacing.

This is to fit the back-plane of the Sinclair.

k. A wire-tapping circuit board, IC socket, etc.

These are used as required.

Construction Techniques

For the actual process of wiring the board, I strongly recommend the use of a wire-wrapping tool. After having had a bit of experience attempting to solder together IC circuits, my initial reaction to using a wire-wrapping was, "Where has this been all my life?"

Remember also that the 8251 is a CMOS chip and that it takes very unkindly to any type of static electricity. The safest way to handle it is to carefully avoid touching the pins with anything. Keep it in conductive foam or stuck into aluminum foil when out of the board, and jam aluminum foil over the wire-wrap pins on the back of the IC socket when inserting the chip into the socket.

I have attempted to use what appears to be the standard form of circuit diagram in Figure 1, but my personal method is to draw a picture of the IC from the bottom (the direction you will be looking at the socket from when wiring it), with the pin numbers and where they will be wired to in the finished product.

Notes on Figure 1

A few notes on Figure 1 will be helpful at this point.

1) The connections indicated as "CPU" on the diagram are connected to the plug you will have made to fit the back the CPU. None of these ICs require buffering.

2) On IC7 (the USART), pins 14, 15,

WHAT ARE YOU WAITING FOR?

INTRODUCING

Z-XLR8

A SOFTWARE BASED CASSETTE TAPE STORAGE SYSTEM FOR ZX81 AND TS1000 COMPUTERS

- **6 TO 10 TIMES FASTER** than Sinclair LOAD and SAVE routines
- **FAST ARRAY VARIABLE** loading and saving independent of program
- **FAST BINARY DATA** loading and saving anywhere in RAM
- **USER FRIENDLY PROMPTING** in either immediate or program modes
- **NO HARDWARE CHANGES.** Period. Works with your existing system
- **LESS THAN 2K OF RAM** is occupied by Z-XLR8, residing between 16-18K, 25-27K, or 30-32K for cassette version. EPROM version resides between 14-16K.

Z-XLR8 CASSETTE $9.50 **Z-XLR8 EPROM $19.50**

ALSO

256 X 192 BIT MAPPED HI RES GRAPHICS FOR ZX81 & TS 1000

COMPLETE PLANS $5.00

ADVANCED INTERFACE DESIGNS

P.O. BOX 1350

STATE COLLEGE, PA 16801

In USA Please Include $1.50 for Prompt Handling and Shipping
Outside USA Include $3.00
PA Residents Add 6% Sales Tax

ZX81 PERSONAL BANKING SYSTEM WITH LOAD/SAVE DATAFILES AT DOUBLE SPEED

Load the program in the normal way—enter, amend or delete your transactions (ZX81 will automatically scan standing order file and post any items due)—save the file of data onto cassette in 45 seconds—load a different datafile into the same program, also in 45 seconds—enter items, etc.—save datafile only onto cassette (45 seconds)—repeat operation for any number of accounts.

Absolutely no need to save *program*, as all information is held in datafiles. Very easy to use—unlike other bank accounts. Requires a minimum of 16K RAM—can use much more (no modification required).

On Demonstration at the next ZX Micro Fair.

The Personal Banking System also includes the following features—

Full page detailed Bank Account, dual display (or printout).
Automatic generation of standing orders on due dates.
Validation of all entries.
Correct any item previously entered. (Single/Multiple field correction)
Enter an item (previously omitted) in the correct date order of the account.
Single key operation. Utilises a M/C keyboard scan.
Search for any item or items by cheque number, description or amount—display (and printout if required) with totals.
Continuous display of statement extract, continually updated during input of entry.
File of standing order details can be displayed, printed, added to, cancelled and amended.
Detailed User Manual.
After sales maintenance.

Send £9.95 ($20) incl. for cassette and users manual to J.P. Gibbons A.I.B., 14 Avalon Road, Orpington, Kent, BR6 9AX, England. (Send large S.A.E. for details).

There are only two suppliers of supported ZX81 software, this is one of them. Be sure to include your name and address.

£6.50 ($13.00) Bank Reconciliation Module—a separate program on cassette that utilises data supplied by the main program (S.A.E. for full details).

The only expandable system for the ZX81.

The Personal Banking System is also available from Sinclair Place, PO Box, 2288 Redmond Wa. 98052 (see their ad), full maintenance still available.

16, 18, and 21 are not required and are not shown on the diagram. Just leave them unconnected.

3) IC3 (the 74LS04) should have all unused inputs tied high to prevent noise problems. This means connect pins 5, 9, 11, and 13 to the +5 volt source (pin 14).

4) The unused Chip Select lines on IC2 (the 74LS08) may be left unconnected.

5) ICs 2 and 3, sections of which are scattered throughout the wiring diagram, both require that pin 14 be +5 volts and pin 7 be ground.

6) ICs 4, 5, and 6 also have several pins unaccounted for in the diagram. Again, leave these pins unconnected.

7) The pin numbers shown beside ICs 8 and 9 are for an RS-232 male connector, meaning the Sinclair is wired as a terminal. If IC9 pins 4 and 10 are tied high with the resistors as shown, they need not be wired to the RS-232 connector and vice-versa.

8) Pins 1 and 7 of the RS-232 connector must be connected to the CPU ground to complete the circuit.

9) Interesting and useful LED indicators can be added to indicate transmit and receive activity. Use a very small LED, with a series resistor (e.g., 2.2K ohms) connected to ground. Wire one of the LEDs to pin 11 of IC 8, the other to pin 1 of IC9.

10) There is the problem of a plug with which to attach the circuit board to the back-plane of the ZX80/81. The normal procedure is to obtain a plug of 1/10 inch spacing and cut it to fit. It would be nice to be able to purchase the correct unit over the counter. There is a very pretty pig-tail pass-through version on the ZX81 printer, but it cannot be bought separately, A diagram of the pin-outs of the back connector is found in the Sinclair manual.

11) Either purchase a general IC data book or obtain a copy of the data specs for the ICs you buy. Radio Shack prints the data specs on the IC package. Other stores will probably supply a copy of the specs on request. This can eliminate many problems, especially misprints in magazine articles. I would also recommend two Radio Shack books: *Engineer's Notebook II*, stock number 276-5002, and the *Archer Semi-conductor Reference Guide,* stock number 276-4005.

12) There appear to be no problems with the calculator power supply which comes with the ZX81. I added an additional 8251 circuit plus an extra 7K of (static) RAM onto my original board, and the entire system still works perfectly well with the original 650 MW power supply.

Building and Testing the Interface Board

The actual construction of the board depends on your experience in such projects. I am a rank amateur so the techniques I used are probably not particularly professional.

The physical layout of the components on the board is a matter of your personal aesthetics, but I would recommend keeping the components which form each subcircuit grouped together on the board, e.g. the clocking circuit, the address select circuit, the RS-232 components, or extra memory. Try various layouts by moving the IC sockets around on the board before wiring them to see what the end result will look like.

The steps I went through in designing and building the interface are roughly as follows:

1) Cut and adapt a plug to fit the backplane of the Sinclair. This step depends on the plug you managed to scrounge and on what you wnat the finished product to look like. When you cut it, remember to leave "ears" on either side so that you can get the plug off the computer again without breaking anything. The plug I found was a wire-wrap type. I pushed the pins through the IC spaced perf board from Radio Shack (stock num-

Z-80
SOFTWARE
NOTEBOOK

A must for anyone wishing to program the ZX-80/81 or TS 1000 in machine language! Contains over 25 useful techniques, utilities and programs that will turn even 1K systems into computing giants.

Sorting, timing loops, searches, block transfers and many more are included. The complete Z-80 instruction set is fully explained and listed. **$7.95 pp.**

BASIC
HANDYMAN

BASIC sub routine that will streamline your program and save your valuable time. Puts the experience of advanced programmers at your fingertips!

Sorting, searching, data files, display file handling, screensave, graphs and special functions galore are given and completely explained. **$6.95 pp.**

FREE TITLE CENTERING ROUTINE WITH ORDER

Z WARE
P.O. BOX 111
ALBANY KTY 42602

ORDER NOW FOR CHRISTMAS

DON'T LET GLITCHES, SPIKES OR POWER FAILURE WIPE OUT YOUR RAM PROGRAM AND DATA. AVOID SYSTEM CRASHES WITH

SYNC - SAVER

RAM BACKUP POWER FOR SINCLAIR

The Sync-Saver is a battery backup that protects your RAM against power interruptions. Simple to use, well engineered, it comes in 2 forms:

SVR-1. A **rechargeable** Nickel-Cadmium battery (included) system to maintain 1K to 16K RAM in the ZX80/ZX81/TIMEX for 1 hour. Batteries recharged automatically. Complete - ready to use.

SVR-2. An **economical** alkaline battery (not included) system to maintain ZX80/ZX81/TIMEX with 1K or 2K RAM for 1 hour. No battery recharge.

Both systems feature added **surge/transient suppression**, ON-OFF switch to reset or turn off computer, and DC ON pilot light.

SVR-1 . . . . . $49.00 SVR-2 . . . . . $17.50
Prices include postage and handling in U.S.
Foreign orders add $2.00
Send check or money order to:

LUXTRON Inc.
241 Winter St., Haverhill, Mass 01830

ber 2276-1396). I ended up with a great board standing up on the back of the Sinclair. This looked fragile and ugly. A better idea would be to use ribbon cable from the computer plug to another, more standard plug and plug-in type wiring board. This also would allow boxing the interface board.

2) Check all the connections with the ICs out of their sockets with a multimeter or continuity tester to eliminate shorts or crossed connections.

3) Next I wired the address select chip and a memory chip onto the board. Only two ICs are required plus a 7441S08. The wiring is simple, and the results are easily verified. (Refer to the paragraph on adding extra memory.) The wire-wrapping tool simplified both the wiring process and the subsequent unwiring of mistakes. If adding the memory is successful, you will have given yourself some extra memory to play with and gained some good experience in wiring techniques.

Remember that on the wiring diagrams the IC pins are numbered looking down from the top whereas the wiring process is performed from underneath. Try writing the pin numbers beside a few of the socket pins on the bottom of the perf board so that you do not get confused when you are looking at it.

Remember also to check the wiring before you apply the power! After the fact diagnosis, by observing which components are smoking, is unprofessional.

4) Once you have given yourself a morale boost by the memory addition, you will be considerably more enthusiastic about approaching the pile of ICs required for the actual I/O circuitry. The order of the wiring probably does not make much difference because without expensive equipment the circuits cannot be tested anyway. I proceeded with the clock circuit, then the 8251, and the RS-232 ICs, in that order.

5) The 9 volt power supply from the Sinclair is perfectly adequate to power the 1488 (pin 14). Connect pin 1 of the 1488 to the negative pole on a square 9 volt battery. Connect the positive pole of the battery to the common ground (pin 7). You can achieve this same effect with any type of power supply of similar voltage.

6) After all the sockets are in place, check the wiring very carefully before plugging in the ICs and applying the power.

7) Testing the completed circuit board should be as simple as attaching a modem and trying out your software. If it does not work, your only recourse is to pull out all the ICs and go over the wiring again very carefully. The only problems I encountered (other than trial-and-error mistakes during the circuit design stage) were directly attributable to mixing the pin numbers when wiring the components.

8) The address select circuit can be tested by changing the select lines on your memory chips, then POKEing and PEEKing at the new addresses. Note that the power-up sequence of the Sinclair will not accept the RAM at other than contiguous addresses, but the POKE and PEEK instructions will function properly.

9) The actual I/O circuit is much easier to test if you can borrow an ASCII terminal. With the terminal you have much more control over what is going in and out of the circuit. You can send and receive one character at a time. Testing with a modem to a remote computer gets a bit tricky because of the longer messages which will be sent to you. Of course, you can always get together with a friend with a Sinclair, build two interface boards, and hook them together for testing.

10) When developing the software to drive this device, start off with a very simple program in Basic. As you send or receive a character or string, use the PEEK command to display the data in memory and the contents of the USART

BARRICADE: HIGH SPEED ACTION GAME - $12.95

"BREAKOUT" for the ZX81! Break through the 5-wall Barricade with the high-speed ball and keyboard controlled paddle! Trap the ball among the walls and watch it destroy the 100 blocks! Select from 96 options (8 speeds, 4 paddle sizes, and 3 ball-angle limits) to challenge both expert and beginner. 3 scores with the best of each saved to be challenged by other players. 100% machine language, so it's fast! 8K/16K. Available now.

ZXM-1: ZX81 MACHINE LANGUAGE MONITOR - $19.95

Based on our popular RSM monitors for the TRS-80, ZXM-1 provides over 15 commands with which you can interact directly with the Z-80 processor in your ZX81. You will have direct access to all memory locations and input/output ports. You may examine your Basic ROM's, test RAM, enter and execute machine language programs, and much more!

A symbolic dump command disassembles object code in memory and displays it as Zilog standard Z-80 mnemonics! All relative addresses are computed and displayed. This is a great aid to understanding the operation of your ZX81 software.

Memory may be displayed in HEX, ASCII, or ZX81 characters. You can SEARCH, EDIT, MOVE, EXCHANGE, VERIFY, FILL, ZERO or TEST memory. Pause, single step or continuous dumps with memory display commands. 16K only. Available Dec 15.

SMALL SOFTWARE SYSTEM

master charge

BANKAMERICARD

SMALL SYSTEM SOFTWARE
Post Office Box 366
Newbury Park CA 91320
Phone: (805) 523-7295

THE BEST VALUE NEXT TO YOUR COMPUTER
IS SUPPORTED SOFTWARE ON CASSETTE

ZX81 MX-PAC TS1000

18 useful/fun programs on CASSETTE make the small memory act like much more-for the whole family..games.. files..lists..SUPER draw-on-tv,security codes..3-D motion and growth simulations..bar graphs..financial helpers(loans,tax)+more+all BASIC ..all explained in Printout 1..

and

1 extraordinary BOOK, Printout 1 shows how the 18 work and GROW and GROW..many ideas..even more line-numbered add-ons for 2K and 16K power-multilevel files,lists,games.. a keyboard "light-pen" that makes draw-on-tv a powerful designing tool-menu-driven programs-financ'l planner ..a complete recipe file (16K)..step by-step build a checking account(16K) -"unbreakable" codes and a challenge THE GREATEST RANGE AND DEPTH OF ANY SOFTWARE is only $24.95..Act today! Send check or MO to ROBILL PRODUCTS 555 PARK AVE.,PATERSON,NJ 07504 ALL ORDERS processed fifo. Please add $2.75 p/h (1st class)NJ res.add 5%

control port to familiarize yourself with the format of the messages and control flags. By starting off simple, you can then proceed to build more complex programs.

Programming Your Sinclair Terminal

The general steps required to transmit and receive data may be related to Figure 2, the sample program listing. The actual steps may vary depending on the specific circumstances. For instance, if you are communicating with another Sinclair, the data do not have to be translated into ASCII and back to the Sinclair Character set.

Receiving Data

1) Initialize the control port to receive.

2) Check the Status Read flags for RxRDY (a character has been received).

3) When a character has been received, move it from the data port to memory.

4) Loop through steps 2) and 3) until a message end character are received. The message end character will depend on whatever protocol has been decided between the sender and receiver. Refer to Figure 8 for the standard ASCII control characters and their meanings.

5) When the message is complete, translate the received ASCII characters to the Sinclair character set and display the result.

Figure 2.

```
     SAMPLE PROGRAM

   5 REM    SET UP LABELS
  10 LET C=21508
  20 LET D=C+1024
  30 LET M=123
  95 REM    INIT TO RECEIVE
 100 POKE C,64
 110 POKE C,M
 120 POKE C,20
 195 REM    READ ROUTINE
 200 LET X$=""
 210 IF PEEK C=133 THEN GOTO 210
 215 REM    SAVE DATA IN X$
 220 LET X$=X$+CHR$ (PEEK D)
 240 IF PEEK D=13 THEN GOTO 300
 250 GOTO 210
 305 REM    TRANSLATE MSG
 320 FOR P=1 TO LEN X$
 330 LET Y=CODE (X$(P TO P))
 340 LET Y=Y-27
 350 IF Y<31 THEN LET Y=Y+7
 360 IF Y<28 THEN LET Y=0
 365 REM    PRINT EACH CHAR
 370 PRINT CHR$ Y;
 380 NEXT P
 390 PRINT
 405 REM    GET MSG TO SEND
 410 INPUT X$
 420 CLS
 505 REM    INIT TO SEND
 510 POKE C,64
 520 POKE C,M
 530 POKE C,49
 605 REM    SEND MESSAGE
 610 FOR Q=1 TO LEN X$
 620 LET Y$=X$(Q TO Q)
 630 LET Y=CODE Y$
 635 REM    TRANSLATE MSG
 640 IF Y$<"A" THEN LET Y=Y+28
 650 IF Y$>"9" THEN LET Y=Y+27
 660 IF Y$=" " THEN LET Y=32
 695 REM    SEND EACH CHAR
 700 IF PEEK C<>133 THEN GOTO 70
0
 710 POKE D,Y
 720 NEXT Q
 795 REM    SEND END OF TEXT
 800 IF PEEK C<>133 THEN GOTO 80
0
 810 POKE D,13
 815 REM    NOW READ AGAIN
 820 GOTO 100
```

Sending Data

1) Initialize the control port to transmit.

2) Input a line (from the Sinclair).

3) Translate each character of the message to ASCII.

4) Check the Status Read flags for transmitter empty (TxMT).

5) When the transmiter is empty, POKE the translated character into the data port.

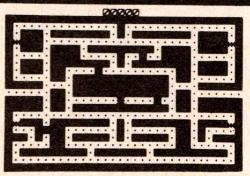
6) Send whatever end of message characters are required by the receiver (LF, ETX, CR, etc.; refer to Figure 8) onto the translated message. Perform steps 4) and 5) for each control character.

This can just barely be done on a 1K machine. Since putting additional RAM on this board is a very minor matter, there is no reason to stay with a 1K machine anyway.

Figure 2 contains a small Basic program whose only value in life is to demonstrate the use of this circuit. It will receive one line of data, then turn around and send one line of data, and on, and on. The messages are assumed to be under 80 characters in length and to consist of nothing but numeric or alphabetic characters. The program will work in 1K if all the REM statements are removed and the messages are kept under 40 characters in length.

SF GOBBLERS

PUCKMAN FOR 16K ZX81



BEAT THAT HIGH SCORE! GOBBLE THOSE DOTS BEFORE THOSE MEANIES GOBBLE YOU! YOUR ONLY AIDES ARE FOUR "POWER PILLS" WHICH MAKE THE MEANIES EDIBLE. BUT NOT FOR LONG!

- MACHINE CODED FOR FAST ACTION
- EXTRA "GOBBLER" FOR 10,000 POINTS
- ON SCREEN SCORING
- HIGH SCORE WITH "ENTER NAME" FACILITY
- UP TO 4 PLAYERS

AN ANNOYINGLY FRUSTRATING GAME ! FOR ONLY $14.95

SF ASTEROIDS FOR 16K ZX81

STAY ALIVE AS LONG AS POSSIBLE IN OPEN SPACE FILLED WITH FLYING ROCKS. SCORE BY SHOOTING THEM – WHICH ALSO CAUSES THEM TO BREAK INTO LOTS OF LITTLE BITS AND MAKES LIFE EVEN WORSE!

- MACHINE CODED FOR FAST ACTION
- ON SCREEN SCORING
- HIGH SCORE WITH 'ENTER NAME' FACILITY
- UP TO 4 PLAYERS
- EXTRA SHIP FOR 1,000 PTS (NOT AS EASY AS IT SOUNDS!)
- SHIP MOVES JUST LIKE ARCADE VERSION
- ROTATE LEFT/ROTATE RIGHT/THRUST
- FIRES IN ALL 8 DIRECTIONS
- INCREASING NUMBER OF ASTEROIDS
- THREE ASTEROID SIZES
- 'NASTY' ALIEN SPACE-SHIP (FIRES BACK!)

THIS GAME IS JUST AS BAD! - AND ONLY $14.95

AN OFFER FOR REAL MASOCHISTS-BOTH TAPES FOR $24.95

MAIL ORDER ONLY-PLEASE MAKE CHEQUE/PO PAYABLE TO

SF THE SOFTWARE FARM DEPT C SF

CRAIGO FARM, BOTANY BAY, TINTERN, GWENT

ENGLAND

OMNI TEMPLATE

FOR ZX-80 and ZX-81

WHAT IS OMNI TEMPLATE?

It is a template program for generating other programs. While developing programs, our staff needed a collection of general utilities to avoid the burden of repeating the same routines over and over. This gave birth to **OMNI TEMPLATE.** We found it so effective that we decided to share it with others.

WHY SHOULD YOU HAVE IT?

It is a great training tool. It helps you to develop a habit of writing professional-looking programs rather than rag-tag patch works. It makes programming fun.

WHAT DO YOU GET?

You will receive a cassette tape of **OMNI TEMPLATE** Program prerecorded and ready to use. Three additional programs: RACING, INDEX-CARDS and FIT-POINTS, which were developed by **OMNI TEMPLATE,** are on the tape in addition to **OMNI TEMPLATE.** A complete listing of **OMNI TEMPLATE** and a well-documented manual describing how to use **OMNI TEMPLATE** is included.

HOW DO YOU GET OMNI TEMPLATE?

It is **$9.50,** if ordered before December 1, 1982. It becomes $14.50 after that. Please add $1.00 for shipping and handling. Send money order or check to:

Omni Technology
P.O. Box 10630
Pittsburgh, Pa 15235

PA resident please add 57 cents for PA sales tax.

Mode Set for the USART Control Port

To initialize the USART, first send it an internal reset. This must be followed by a mode set, then the required control command. All of these steps are accomplished by POKEing the correct values into the address at which the control port has been wired.

The values of the various bits in the Mode Instruction are shown in Figure 3. Take the decimal value given for each bit to be on in the instruction, and add them together to obtain the value to be POKEd into the Control Port address. The Basic code is from the sample program in Figure 2.

For example,

```
10 LET C=21508
   (address of USART control port)
20 LET D=C+1024
     (address of USART data port)
30 LET M=123
     (mode setting)
```

When using this circuit connected to a telephone modem dialed to the DATA-PAC network, the mode setting is 123d, or 7Bh. Referring to Figure 3, this translates to:

1)1 stop bit (S2=0,S1=1:bit value=64).
2) Even Parity (EP=1 : bit value=32).
3) Parity checking Enabled (PEN=1 : bit value=16).
4) 7 bits/character (L2=1,L1=0 ; bit value=8).
5) BAUD rate =300, 1/64 data clock rate (B2=1,B1=1 : bit value=3).

Adding these bit values together we get: 64+32+16+8+3=123.

USART Command Instructions

Command Instructions are used to specify to the USART what operations you require that it perform. In this circuit, we are mainly interested in READ and Write DATA, and can ignore the device control commands.

```
100 POKE C,64     force an internal
                    reset of USART
110 POKE C,M      reset mode setting
                    see above
120 POKE C,20     initialize for
                    receiving
```

The command value 20 above is derived from Figure 4 as:
1) Error Reset (ER = 1 : bit value 16)
2) Receive ENable (RxEN = 1 : bit value 4)
Adding these bit values together we get:
16 + 4 = 20. Or,

```
510 POKE C,64     force an internal
                    reset of USART
520 POKE C,M      reset mode setting
                    see above
530 POKE C,49     initialize for
                    transmission
```

The command value 49 above is again derived from Figure 4 as:
1) Ready to send (RTS = 1 : bit value 32)
2) Error Reset (ER = 1 : bit value 16)
3) Transmit ENable (TxEN = 1 : bit value 1)
Adding these bit values together we get: 32 + 16 + 1 = 49.

Checking the USART Status Read Flags

The Status Read Flags on the USART are set by that unit depending on what you have instructed it to do by the last command sent to the Control Port. These flags are presented at the Control Port after a data character has been read, or a character transmitted. The problems occur here because the Sinclair Basic language is limited to testing byte values, and the flags are actually separate bits.

I have been unable to dream up a bit checking algorithm in Basic which is fast enough to keep up with receiving data, even at only 300 BAUD. The labels "C" (Control port), and "D" (Data port) are as defined in the sample program listing, Figure 2. The Basic instructions as coded will work perfectly well at 300 BAUD until there is a transmission error (not common at all at that speed). As soon as a transmission error occurs, extra status bits reflecting the problem are set, and the program will loop. At that point,

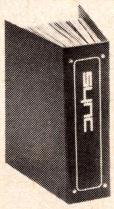
SHELF CONSCIOUS?

Now you can organize your copies of

SYNC

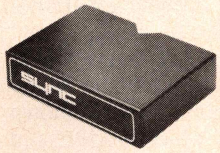
Now your magazines can be a handsome addition to your decor, well organized, and easy to find, thanks to these durable library-quality cases or binders. They're made of luxury-look leatherette over high-quality binder board. And both styles are custom-designed for this or any other magazine you save, with size, color and imprint selected by the publisher. FREE transfer foil included for marking dates and volumes.

Magazine binders



hold a year's issues on individual snap-in rods, combining them into one volume. $7.95 each; 3 for $22.50; 6 for $42.95. Mixed titles OK for quantity prices.

Open-back cases



store your issues for individual reference. $6.95 each; 3 for $19.75; 6 for $37.50. Mixed titles OK for quantity prices.

For faster service, **CALL TOLL-FREE 24 HOURS: 800-345-8112.** (In PA only: 800-662-2444.)

Sync
P.O. Box 5120, Philadelphia, PA 19141
Please send: ☐ Cases ☐ Binders

TITLE — QUANTITY

Sync _____

Other: _____ _____

☐ PAYMENT ENCLOSED $_____* Add $1.00 *per order* for postage and handling. Outside USA add $2.50 *per unit* ordered; send US funds only.

☐ CHARGE (Minimum $10):
☐ American Express ☐ MasterCard
☐ Visa

Card No._____Exp. Date_____

Signature_____

Print Name_____

Address_____

City_____

State/Zip_____

*Residents of PA add 6% sales tax.

THE DIGGLES KITCHEN

NEW - UNIQUE SOFTWARE FOR THE ZX81 - 16K

Original recipes from simple suppers to celebration dinners, compiled by John and Angela Diggle for Micro Computer Software UK.

Cassette 1. 28 WORLD WIDE RECIPES including traditional English dishes like - Lancashire Hot Pot, Steak and Kidney Pie.

Cassette 2. 26 EUROPEAN RECIPES including main meals, vegetables and desserts like - Braised Steak in Guinness, Courgettes Natural, Crepes Suzette

Cassette 3. 28 EVERYDAY FAMILY MEALS. Looking for something different but inexpensive? like - Onion Soup Gratinee, Lamb Stew, Stuffed Marrow

Available soon Cassette 4 - Indian Cookery and Cassette 5 - Chinese cookery. You can build up a world wide cookery book of original recipes on cassettes.

Price per Cassette - ONLY **$9.99** .....a most acceptable Christmas gift

Send your remittance to - **THE DIGGLES KITCHEN, MICRO COMPUTER SOFTWARE UK, UNIT D.6 PEAR INDUSTRIAL ESTATE, STOCKPORT RD, LOWER BREDBURY, STOCKPORT SK6 2BP. ENGLAND.**

Please add $2. per order for air mail.

Figure 3. 8251 USART Mode Instruction Format.

D7	D6	D5	D4	D3	D2	D1	D0	Bit Number
128	64	32	16	08	04	02	01	Value (decimal)
80	40	20	10	08	04	02	01	Value (hex)
S2	S1	EP	PEN	L2	L1	B2	B1	Label

S2	S1	MEANING	L2	L1	MEANING
0	0	Invalid	0	0	5 bits
0	1	1 stop bit	0	1	6 bits
1	0	1 1/2 stop bits	1	0	7 bits
1	0	2 stop bits	1	1	8 bits

PEN	MEANING	EP	MEANING
1	Enable	1	Even parity
0	Disable	0	Odds parity

B2	B1	MEANING
0	0	invalid
0	1	data clock / 1
1	0	data clock / 16
1	1	data clock / 64

Figure 4. 8251 USART Command Instruction Definition.

D7	D6	D5	D4	D3	D2	D1	D0	Bit Number
128	64	32	16	08	04	02	01	Value (decimal)
80	40	20	10	08	04	02	01	Value (hex)
EH	IR	RTS	ER	SBRK	RxEn	DTR	TxEN	Label

```
EN    ; not used (synchronous mode only).
IR    ; Internal Reset.
          1 = reset the USART control port.
RTS   ; Ready to Send modem control.
          (not required)
ER    ; Error Reset (the USART will still run with errors).
          1 = reset error status flags.
SBRK  ; Send BReaK (to interrupt incoming transmission;
        used only in sophisticated time sharing type
        applications only).
          1 = send break.
RxEN  ; Receive ENable.
          1 = get ready to receive data.
DTR   ; Data Terminal Ready modem control.
          (not required)
TxEN  ; Transmit ENable.
          1 = get ready to send data.
```

nothing else will happen, and you will have to thump on the BREAK key, and rerun the program.

Receiving data:

```
210 IF PEEK C=133 THEN GOTO
210
220 LET X$=X$+CHR$ (PEEK D)
```

Line 210 waits for the incoming character and loops itself until "RxRDY" (Figure 5) is turned on by the USART. The initializing of the USART will always result in a value of 133 for the flags (DSR, TxMT, and TxRDY) when in receive mode—a total value of 133.

Line 220 gets the received character value and is executed when something happens (either a valid character was received or an error condition posted). Since speed is of the essence at this point, to avoid data overrunning your program, the best bet is to ignore checking the error flags entirely and depend on the screen display alerting you to the error. Now that the Data Port (PEEK D) contains the received character, you can do with it what you want (always bearing in mind that you do not have any time to do anything much with it). If you write your terminal program in assembler or machine code you can do an incredible amount of processing between characters at 300 BAUD.

Transmitting Data:

```
700 IF PEEK C=133 THEN GOTO
    700
710 POKE D,Y
```

Line 700 waits for clear status.

Line 710 transmits the character value to Data Port.

In this example, we wait for the ready to transmit flags to be posted by the USART in the Control Port. The value 133 is again derived from the total of DSR, TxMT and TxRDY. When (and if) this set of flags and no others are set, we proceed to line 710, which places the value of the character to be transmitted (in operator label "Y") into the Data Port. As soon as your program does that, the USART will turn off flag TxRDY, and possibly TxMT until it has disposed of the data character, at which time it will turn the two flags back on again ready for the next character. (Your Basic program will be hard pressed to keep up with this sequence of events, but there are no time constraints when you are the sender.)

Adding RAM

Figure 6 shows a circuit diagram for adding extra RAM to your Sinclair by using the Chip Select lines which are not required for the USART circuit. Again, this follows the example from David Sommers' article "Experiments in Memory and I/O Expansion." I have shown only a 2K x 8 bit 2016 which is addressed as locations 17,408 to 19,455. The same principle applies for adding extra RAM

Figure 5. 8251 USART Status Read Definition.

D7	D6	D5	D4	D3	D2	D1	D0	Bit Number
128	64	32	16	08	04	02	01	Value (decimal)
80	40	20	10	08	04	02	01	Value (hex)
DSR	SYNDET	FE	OE	PE	TxMT	RxRDY	TxRDY	Label

```
DSR     ; Data Set Ready.
              1 = modem is up.
SYNDET  ; Break received.
              1 = break was received.
FE      ; Framing Error.
              1 = invalid character received; probably timing.
OE      ; Over-run Error.
              1 = data was received faster than your program
                  accepted it; data was lost.
PE      ; Parity Error.
              1 = transmission error, or parity differs between
                  send and receive circuits.
TxMT    ; Transmitter eMpTy.
              1 = buffer ready to send another character.
RxRDY   ; Receive buffer ReaDY.
              1 = received data character ready to be accepted
                  by CPU.
TxRDY   ; Transmitter ReaDY to accept another character.
              1 = ready to send another character.
```

Figure 7. RS-232 Standard for 25 pin "D" connector.

PIN	USE (USART)	CONNECT TO
3 *	Received data	pin 1 on 1489
2 *	Transmit data	pin 11 on 1488
1 *	Signal ground	CPU ground
7 *	Signal ground	CPU ground
6	Data Set Ready	pin 4 of 1489
5	Clear to send	pin 10 of 1489
20	Data Terminal Ready	pin 8 of 1488
4	Ready to Send	pin 6 of 1488

1) The pins marked with an asterisk (*) are required, the others are optional, but may, if omitted, cause error conditions to be posted by the USART.

2) This pin configuration is for a male ""D'' connector, which assumes that the Sinclair is to be attached to a standard RS-232 modem.

Figure 8. ASCII Terminal Control Characters.

ID	HEX	DEC	DESCRIPTION
CR	0D	13	Carriage Return: usual end of message code
LF	0A	10	Line Feed: sometimes precedes CR
NULL	00	00	Null data: used after LF for timing

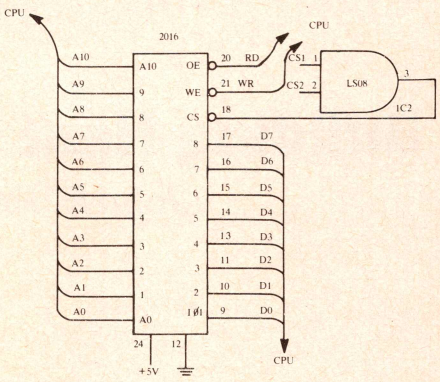
Standard protocol when a computer is communicating with a terminal is to conclude each line of data with:

1) A carriage return (CR) to move the cursor back to the left hand side of the screen or carriage.

2) A line feed (LF) to scroll the screen up 1 line, or advance the paper 1 line.

3) One or more nulls (8 hex zeroes)--these are only to give a mechanical terminal time to finish returning the carriage for the next line.

Figure 6. Additional RAM Wiring Diagram.



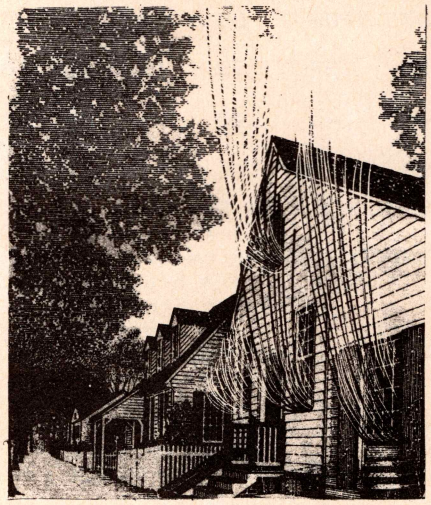
modules beyond this range, just use the Chip Select lines in order as they are numbered so you do not leave any "holes" in the RAM addresses. I used TMM2016P-1 chips by Toshiba, but any high-access speed similar chips will do as well. (The 2016P-1 has a 100 nano-second access time).

These are extremely simple to wire: the address and data pins of the chip go straight to the identical pins on your plug for the back of the CPU, the two Chip Select lines (because this is a 2K chip) are combined with a 74LS08 and thence to the Chip Select pin of the RAM IC, and power and ground as appropriate. The entire wiring operation only takes about 15 minutes.

Testing the chip to see that it is operational is just as simple. First, double check your wiring (these are $10 chips), then fire up the Sinclair, with the chip OUT of the socket. PEEK location 16389 and remember the value. Power off the Sinclair, press the IC into the socket (right way round, of course), and again power up the Sinclair and PEEK the same location. If everything is correct, you should notice a slightly longer delay before the cursor shows on the screen as the ROM routines check out the new core, and location 16389 should contain a value 8 higher than the value you noted previously. (This location incidentally, is where the ROM power-up routines save the address of the last useable byte of memory).

If this is not the case, verify the wiring again, especially the Chip Select lines. Try POKEing and PEEKing various locations inside the address range of the new chips. See if the POKEd values actually remain in memory, or if they change in a regular sequence (data lines crossed). Crossed address lines will result in POKEd values going to another location in the address range which is harder to pin down. If there is no power to the chip, the address locations will reflect back either "0" or "255".

8K ROM
1K RAM



Building Heat Load

John E. Reinhardt

Although energy conservation has become a buzz word in recent years, we are constantly reminded of the need to conserve energy by our monthly electric and heating bills. We are urged to upgrade our home energy systems by buying more insulation, adding solar heating, and installing more efficient electric and heating equipment.

Making such choices requires taking many variables into account if we are to avoid ending up spending more money to upgrade than the upgrading will save. This article gives a program for calculating your building heat load. You may not find all the answers, but you can get a preliminary comparison of some of the options.

The program is designed to find the heat load by solving two equations.

The first equation is

$$Q = \frac{1}{R} A \Delta T$$

where

Q = Heat flow rate (Btu per hour).

R = Heat flow resistance (hour x square feet x degrees Fahrenheit divided by Btu).

A = Area of walls, ceiling, etc. (square feet).

ΔT = Average temperature difference between the inside of the wall and the outside (degrees F).

The second equation is

$$Q = \rho V Cp \Delta T L$$

where

Q = Heat flow rate (Btu per hour).

ρ = Density of air (0.075 16 per cubic foot).

V = Air infiltration rate (cubic feet per hour per feet of crack).

Cp = Specific heat of air (0.24 Btu per pound).

ΔT = Average temperature difference between inside air and outside air (degrees F).

L = Crack length (feet).

The variables needed to run the program are as follows:

TI = Average inside temperature (degrees F).

T = Average ground temperature or outside temperature (degrees F).

R = R value of floor, ceiling, walls, or windows (hours x square feet x degrees F divided by Btu).

A = Area of floor, ceiling, etc. (square feet).

CL = Crack length (feet).

IR = Infiltration rate (cubic feet per hour per foot).

Q = Heat load (Btu per hour).

Table 1 lists the R values for computing the heat loss, and Table 2 lists the infiltration rate data.

Enter the program on your computer, SAVE it, and then hit RUN and ENTER. The program will then ask for the data. Your data will appear on the screen.

Table 1. R Value.

Material	Thickness	Resistance
Insulation	3"	10
Insulation	6"	20
Insulation	9"	30
Concrete	6"	2
Single Pane Window	—	0.9
Double Pane Window	—	1.7

Table 2. Infiltration Rate (cubic ft/hr/ft).

Crack Location	Wind Velocity, MPH				
	5	10	15	20	25
Masonery wall not caulked	3	8	14	20	27
Masonery wall caulked	1	2	3	4	5
Average Window non-weatherstripped	7	21	39	59	80
Average Window weatherstripped	4	13	24	36	49
Poor Fitted Window non-weatherstripped	27	69	111	154	199
Poor Fitted Window non-weatherstripped	6	19	34	51	71

John E. Reinhardt, 230 Pine Ridge Rd., Madison, AL 35758.

When the screen fills, hit CONT and ENTER. Continue adding data as called for. The Building Heat Load is the final number printed. Analyze each option you are considering with this program, and then you can decide which option will give the results you want.

The program can be readily expanded for 16K RAM. Tables 1 and 2 could be listed in the program enabling the user to compute the variables.

The following list of data will enable you to try out the program:

TI = 70
T (ground) = 50
T (outside) = 30
R (floor) = 2
R (ceiling) = 20
R (wall) = 10
R (window) = 1.7
Crack length = 300 ft.
Infiltration rate = 13
A (floor) = 1500 sq. ft.
A (ceiling) = 1500 sq. ft.
A (wall) = 1200 sq. ft.
A (windows) = 200 sq. ft.

The heat load for this set of data is 30313.882 Btu/hr. One kw equals 3.413 times 10^3 Btu/hr. Thus the heat load equals 8.88 kw. Given a 30 day period and electric heat at a cost of 5 cents per kwh, this amounts to $319.68.

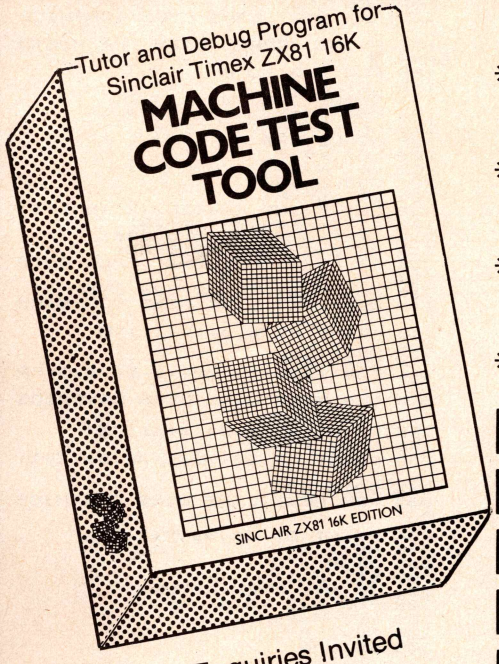
Listing 1. Building Heat Load Program.

```
 20 LET QT=NOT PI
 30 PRINT "INSIDE TEMP  ";
 40 INPUT TI
 50 PRINT TI
 60 FOR M=SGN PI TO VAL "4"
 70 LET N=M+NOT PI
 90 IF M>=INT PI THEN GOTO VAL
"150"
 100 IF N=SGN PI THEN PRINT "GRO
UND TEMP  ";
 110 IF N=VAL "2" THEN PRINT "OU
TSIDE TEMP ";
 130 INPUT T
 140 PRINT T
 150 IF M=SGN PI THEN PRINT "FLO
OR"
 160 IF M=VAL "2" THEN PRINT "CE
ILING"
 170 IF M=INT PI THEN PRINT "WAL
L"
 180 IF M=VAL "4" THEN PRINT "WI
NDOW"
 190 PRINT "R VALUE  ";
 200 INPUT R
 210 PRINT R
 220 PRINT "AREA  ";
 230 INPUT A
 240 PRINT A
 250 LET Q=A*(TI-T)/R
 260 LET QT=QT+Q
 270 NEXT M
 280 PRINT "CRACK LENGTH"
 290 INPUT CL
 300 PRINT CL
 310 PRINT "INFIL RATE"
 320 INPUT IR
 330 PRINT IR
 340 LET Q=CL*IR*(TI-T)*.018
 350 LET Q=QT+Q
 360 PRINT "HEAT LOAD, BTU/HR: "
Q
```

Line notes:

20 Initialize heat load.
40 Input building temperature.
130 Input ground or outside air temperature.
200 Input heat conduction terms.
230 Input surface areas.
290 Input crack length.
320 Input infiltration rate.
340 Compute infiltration.
350 Sum heat loads.
370 Printout heat load.

At Last Your Chance To Crack The Machine Code



Trade Enquiries Invited

ZX81 and SPECTRUM OWNERS

* If you are interested in finding out how a computer **really** works and want to experience true programming power – the machine Code Test Tool is the answer.
* The Machine Code Test Tool is a utility program which comes complete with tutorial course enabling you to enter, test, display and debug hexadecimal machine codes simply and quickly.
* The Machine Code Test Tool is constructed to help the absolute beginner who wishes to explore this fascinating subject, or the expert keen to polish up his machine code programs.
* A HEX: decimal conversion routine is contained within the program as standard.

Post to: R. L. ASSOCIATES, 614 W. Manchester Blvd., Inglewood, Cal. 90301

Please rush.....ZX81.M.C.T.T. at $19.95 ($25.95 Canada)

Send payment to above address

NAME .....

ADDRESS .....

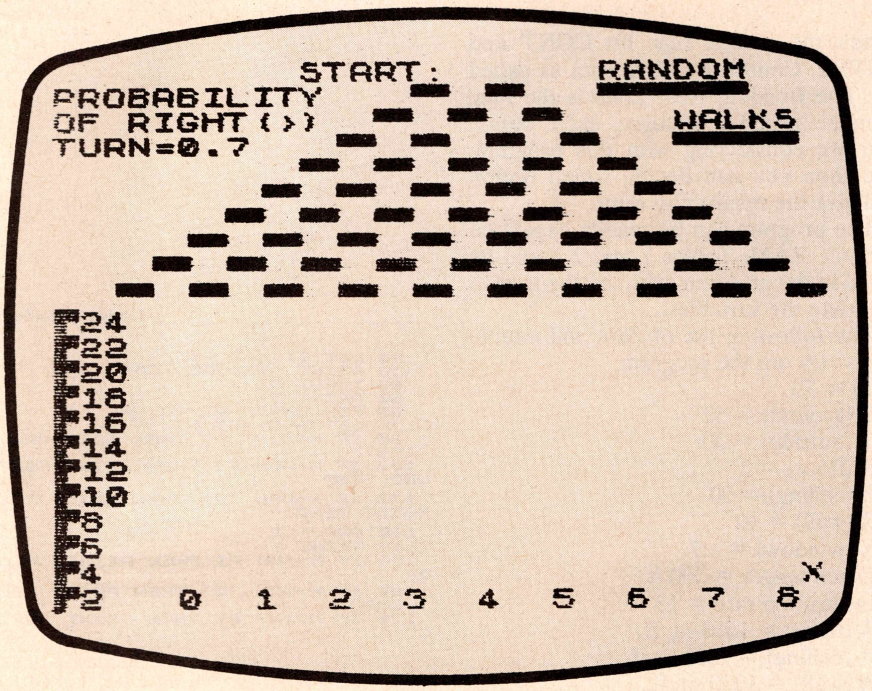
STATE..... ZIP..... R.L.I

Allow up to 28 days for postage

8K ROM
16K RAM

Random Walks

Eric Chandler



Most students of statistics are familiar with the "Random Walk" problem: A person passes through a series of doors and after each he is presented with the choice of turning right (with fixed probability P) or turning left, and thereafter encounters another door. If, say, there are 9 levels of doors, the possible outcomes may be characterized by the number of times X he turns right, from X=0 to X=8. We can find the probability of each of these outcomes by the formula

$$Pr(X) = \binom{8}{X} P^X (1-\rho)^{8-X}$$

and the resulting distribution is called "binomial."

The most commonly seen of these distributions result when P=½: The so-called "bell shaped" carve which can be approximated by the normal function

$$Y = \frac{1}{\sigma\sqrt{2\pi}}\ e^{-\left(\frac{X-\mu}{\sigma}\right)^2/2}$$

where the mean $\mu = P$ and the standard deviation

$$\sigma = \sqrt{P\ (1-P)}.$$

An exceedingly clever device called the "Hexstat" illustrates this distribution. A large number of small steel balls in a transparent casing roll down through a cascade of bifurcated channels and collect in 9 columns in the familiar bell shape.

A program "Random Walks" for the ZX81 duplicates the Hexstat. It is an eye-catching, pretty display and very effective as an instructional device. Over a period of 15 minutes or so a series of "balls" falls down through a cascade or sieve to form 9 columns whose heights are proportional to the respective proba-

```
   1 REM "RANDOM WALKS".LINE 3 U
SES GRAPHICS E.
   2 FOR N=0 TO 11
   3 PRINT AT 21-N,0;"▛";2*(N+1)
   4 NEXT N
   5 PRINT AT 0,10;"START:
RANDOM"
   6 FOR N=44 TO 55
   7 PLOT N,41
   8 NEXT N
   9 PRINT AT 2,25;"WALKS"
  10 FOR N=50 TO 59
  11 PLOT N,37
  12 NEXT N
  13 FOR N=1 TO 9
  14 LET Y=43-2*N
  16 LET X=28-3*N
  18 FOR M=1 TO N+1
  20 FOR T=1 TO 3
  22 LET X=X+1
  24 UNPLOT X,Y
  26 NEXT T
  28 FOR T=1 TO 3
  30 LET X=X+1
  32 PLOT X,Y
  34 NEXT T
  36 NEXT M
  38 NEXT N
  40 FOR N=0 TO 8
  42 PRINT AT 21,5+3*N;N
  44 NEXT N
  45 PRINT AT 20,30;"X"
  46 PRINT AT 1,0;"ENTER PROB."
  48 PRINT AT 2,0;"OF RIGHT(>)"
  50 PRINT AT 3,0;"TURN"
  52 INPUT P
  54 PRINT AT 1,0;"PROBABILITY"
  56 PRINT AT 2,0;"OF RIGHT(>)"
  58 PRINT AT 3,0;"TURN=";P
  59 LET PR=1-P
  60 DIM A(9)
  61 FOR N=1 TO 9
  62 LET A(N)=24
  64 NEXT N
  65 RAND 0
  66 LET X=33
  67 LET Y=42
  68 PLOT X,Y
  69 GOTO 84
  70 LET S=SGN (RND-PR)
  72 IF S=0 THEN GOTO 70
  74 FOR N=1 TO 3
  76 UNPLOT X,Y
  78 LET X=X+S
  80 PLOT X,Y
  82 NEXT N
  84 FOR N=1 TO 2
  86 UNPLOT X,Y
  88 LET Y=Y-1
  90 PLOT X,Y
  92 NEXT N
  94 IF Y=24 THEN GOTO 98
  96 GOTO 70
  98 FOR N=1 TO A((X-3)/6)
 100 UNPLOT X,Y
 102 LET Y=Y-1
 104 PLOT X,Y
 106 NEXT N
 108 LET A((X-3)/6)=A((X-3)/6)-1
 110 IF A((X-3)/6)=0 THEN GOTO 1
14
 112 GOTO 66
 114 FOR N=1 TO 100
 115 NEXT N
 120 FOR L=0 TO 8 STEP 2
 122 FOR C=0 TO 29
 123 REM NEXT 2 LINES USE GRAPHI
CS: INV.VID.P,7 AND SPACE,6.
 124 PRINT AT L,C;"▛"
 126 PRINT AT L+1,C;"▙"
 128 FOR N=1 TO 3
 130 NEXT N
 135 REM NEXT LINE USES GRAPHICS
T.
 140 PRINT AT L+1,C+2;"▜"
 142 NEXT C
 144 PRINT AT L,30;"  "
 146 PRINT AT L+1,30;"  "
 148 NEXT L
 149 PRINT AT 7,18;"▛▀"
 150 PRINT AT 8,18;"▌▀"
 151 FOR N=1 TO 50
 152 NEXT N
 153 PRINT AT 8,19;"  "
 154 PRINT AT 6,22;"  "
 155 PRINT AT 7,22;"  "
 156 PRINT AT 8,22;"▀▀▀▀"
 162 LET A=0
 164 FOR M=1 TO 9
 168 LET A=24-A(M)+A
 172 NEXT M
 176 PRINT AT 0,0;"THERE WERE ";
A;" BALLS IN ALL."
 178 PRINT "FOR EACH OUTCOME X W
E COMPUTE"
 180 PRINT "THE EXPECTED NUMBER
OF BALLS "
 182 PRINT "E(X) BY THE BINOMIAL
FORMULA AND"
 183 REM NEXT LINE USES GRAPHICS
A.
 184 PRINT "GRAPH WITH THE HISTO
GRAM ▀."
 188 FOR X=0 TO 8
 190 LET N=8
 192 GOSUB 300
 194 LET EF=F
 196 LET N=X
 198 GOSUB 300
 200 LET XF=F
 202 LET N=8-X
 204 GOSUB 300
 206 LET QF=F
 208 LET E=INT (A*(EF/(XF*QF))*(
P**X)*((1-P)**(8-X))+.5)
 210 IF E=0 THEN GOTO 236
 212 IF E=1 THEN GOTO 234
 214 IF E/2<>INT (E/2) THEN GOTO
224
 216 FOR Y=21 TO 22-E/2 STEP -1
 217 REM NEXT LINE USES GRAPHICS
A
 218 PRINT AT Y,3*(X+1);"▀"
 220 NEXT Y
 222 GOTO 236
 224 FOR Y=21 TO 22-(E-1)/2 STEP
-1
 225 REM NEXT LINE USES GRAPHICS
A.
 226 PRINT AT Y,3*(X+1);"▀"
 228 NEXT Y
 230 PRINT AT 22-(E+1)/2,3*(X+1)
;"▀"
 232 GOTO 236
 233 REM NEXT LINE USES GRAPHICS
D
 234 PRINT AT 21,3*(X+1);"▄"
 236 NEXT X
 286 STOP
 300 LET F=1
 301 IF N=0 THEN RETURN
 302 FOR M=1 TO N
 303 LET F=F*M
 304 NEXT M
 305 RETURN
```

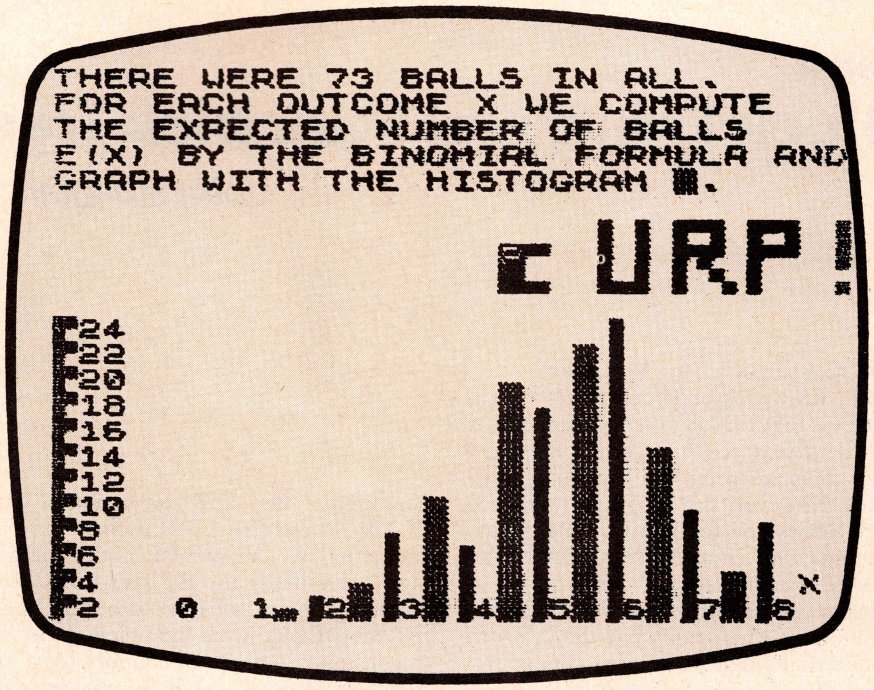
Eric Chandler, RMWC, Lynchburg, VA 24503.

bilities of the outcomes. When the tallest column reaches the bottom of the sieve the process stops. By entering different values of P at the beginning of the program, distributions skewed right or left may be produced. A typical display at this point is shown in Figure 1.

After a short pause (whose duration may be adjusted at line 114) the program continues. The top part of the display is eaten up by a little gobbler who finishes it off with a humorous embellishment. The total number of balls involved is calculated and the expected number of balls in each outcome is computed by the binomial formula and displayed in a contrasting histogram alongside the actual outcomes.

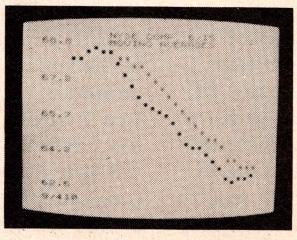
To execute the program after it is entered or loaded, hit RUN, and the fixed part of the display will be drawn. The program then asks for the probability of a right turn (your right) and a number between 0 and 1 inclusive is entered. The rest of the program runs without interruption. ■

Figure 1.



STOCK MARKET PRICE ANALYSIS

HELP! for the Small Investor



Now SINCLAIR ZX-81 (16K) owners can do what the professional market traders do — use a computer to predict *price direction*. This program tracks up to six stocks, averages, or commodities, and produces *graphs* and uses technical indicators to help you make trades.

Technical analysis is based on two ideas: first, that the market, like the rest of human behavior, repeats itself; and second, that there are professionals and insiders who know what the market is going to do before everyone else does, and who place trades in a way that is hardly noticeable. TECHNICAL ANALYSIS attempts to read the price action and volume figures to determine whether predicable patterns are developing, and what the professionals are doing.

Professional traders have been using computers to make this kind of analysis for years, because the manipulation of the data is very complicated and time-consuming. With this program, you let the computer do the work, and its signals become a powerful investment tool.

The program makes *GRAPHS* of the daily prices, of two moving averages, and of a volume indicator. A booklet that comes with the program helps you learn what to look for.

The program does an *ANALYSIS* to signal trend-formation and turn-arounds. It gives a score for each indicator, and a total score, to help you see whether there is confirmation among the signals.

USE THIS TO TRADE STOCKS, OPTIONS, AND THE NEW STOCK INDEX FUTURES!!

This gives POWER TO THE SMALL INVESTOR!

For program tape and booklet send $30.00 to:

NOOTER STOCK PROGRAM
320 East 25th Street
New York, N.Y. 10010

(N.Y. residents, add $2.48 sales tax.)

50 NIFTY 1K PROGRAMS FOR THE ZX81

A large variety of great games, interesting activities, and plenty of graphics, providing hours of fun for the whole family.

Also available

50 nifty programs for your Timex Sinclair 1000.

Same great programs, but upgraded for 2K machine. The result is very user friendly with additional levels of play.

$9.95 each includes postage/handling

Listings and cassettes available: send sase for free catalogue.

JENN PRODUCTS
BOX 246
HARRISON, ME. 04040

8K ROM
1K RAM

Part 2

Block Transfers: Variables Transfer

John Hoagland-Scher

The Problem of Saving Variables

One drawback of Timex/Sinclair computers is that LOADing a program erases any data that you have in the variables area to make room for in-coming variables. However, the program developed here allows you to keep variables in the machine safe from NEW, CLEAR, and LOAD. Furthermore, it allows you to transfer variables from one Basic program to another. This spares you the effort of re-entering a data base in each new program that you wish to use it in. You can even combine data stored in several different programs into a single data base, a facility you may desire should you upgrade your computer with additional memory. The heart of the Variables Transfer routine consists of block transfers to and from the space above RAMTOP of the sort we began exploring in Block Transfers, Part 1, in the last issue.

Those of you who completed Part I will have an easier time understanding the workings of the machine code presented here. However, even if this is your first attempt at a machine language program, you can cook-book your way through without much trouble. Chapters 24 through Appendix A of the Sinclair manual or Chapters 23 through Appendix A of the Timex/Sinclair manual and Dr. Ian Logan's article "An Introduction to Machine Language" are useful, but not essential references. (See *SYNC* 1:6 or the *SYNC* special issue.)

The Variables Transfer Routine

Because Timex/Sinclair users now have anywhere from 1K to 56K of RAM, the Variables Transfer routine was written so that it will operate at any location in memory. In fact, the program modifies itself according to where it is located in memory, and according to how large the variables are that you wish to transfer. *You* do not have to change a single byte.

As in Part 1, the block transfers used here employ the LDIR instruction of the Z80(A). Recall that LDIR uses three register pairs, BC, DE, and HL, in the following way. Initially the BC pair holds the number of bytes (#bytes) to be transferred, the DE pair holds the first address of the destination block of memory (dest'n) to which information will be transferred, and the HL pair holds the first address of the block of information that you wish to transfer (source). The LDIR instruction transfers the contents of the address held in the HL pair to the address held in the DE pair, then it increments (adds 1 to) HL and DE, and decrements (subtracts 1 from) the BC pair. It then compares BC to zero,, and if BC is not equal to zero, the instruction is repeated. Otherwise the next instruction is executed. Thus the BC pair is a count-down register which reaches zero when the entire block has been transferred. Examine the blocks labeled A, C, F, and G in Figure 2. For now just look at column 5. Each of these blocks is a block transfer routine illustrating the use of the three register pairs and the LDIR instruction as just described. I will explain more about these blocks, and about how the program modifies itself later. Right now we should get down to business.

An Overview of the Process

In summary, what we will do is load a machine language routine into the space above RAMTOP, then transfer it to a SAVEable REM statement for future use. Then we will put it back up above RAMTOP and illustrate its uses with a pair of simple Basic programs. Before beginning you must reserve enough space above RAMTOP to accomodate the Variables Transfer routine (block D, figure 2), along with blocks A and C which will eventually be dispensed with. To do this, change RAMTOP to 17302 by typing POKE 16388,150 and ENTER, then POKE 16389,67 and ENTER, then hit NEW. Even if you have additional memory, you must load the machine language into the addresses in column 1 in Figure 2 initially, although this will not restrict future use of the program, so set RAMTOP to 17302 as above.

Beginning with Hex Loading

Now enter the hex loading program shown in Figure 1. This program is identical to the loading program that we used in the last issue, with the exception of the address in line 280, 17302. When you RUN this program, the screen will prompt you for a byte in hexadecimal. Begin entering the bytes listed in column 4 in Figure 2 (i.e., enter two digits from the column at a time as follows: type 01 and ENTER, then 5C and ENTER, 00 and ENTER, 11 and ENTER, and so on until you have finished entering the entire column, then type END and ENTER). Note that the program gives you a back-space key, '/', in case you ENTER the wrong byte. Remember also that in a hexadecimal listing like that shown in column 4, Figure 2, 0 is always a zero and never the letter 0.

Once you type END and ENTER, you can check to see that you did not leave any bytes out by typing PRINT PEEK 17405. The number 201 should appear on your screen (201d = C9h). Now SAVE the hex loading program for future use, then type NEW and ENTER to clear but the memory. Put the machine into FAST mode and enter a REM statement with 92 X's (i.e., type 1 REM XXXXX . . .etc., then ENTER). You can change back to SLOW now. Note that the first X in the REM statement is at the address 16514. Now look more closely at block A, column 5 and 6 of Figure 2. Convince

John Hoagland-Scher, 222A Hamilton St., Cambridge, MA 02139.

yourself that block A transfers block B from the addresses in column 1 to the addresses in column 2, the REM statement addresses. Call the routine in block A by typing RAND USR 17302 and ENTER, then ENTER again. Your REM statement should now contain the character representation of the bytes in block B (see Appendix A of your manual). The last character in the REM statement should be TAN if all has gone properly. If your REM statement remains full of X's, you had better PRINT PEEK a few addresses between 17302 and 17313 to be sure that you entered block A properly.

Now that the Variables Transfer routine is in a SAVEable REM statement, SAVE it under a name such as "VARIABLES TRANSFER" or some suitable shorter mnemonic. Be sure your SAVE was successful.

Figure 1.

```
   1 REM FROM BOOTH, SYNC VOL.2,
NUMBER 1
 200 LET V=-1
 210 LET V=V+1
 220 IF INT (V/50)*50=V THEN CLS

 230 INPUT H$
 240 IF H$="" THEN GOTO 230
 250 PRINT H$;"#";
 260 IF H$="END" THEN STOP
 270 IF H$="/" THEN GOTO 300
 280 POKE 17302+V,16*CODE (H$)+C
ODE (H$(2))-476
 290 GOTO 210
 300 LET V=V-1
 310 GOTO 230
```

Using over 1K RAM

At this point those of you with more than 1K RAM can begin to take advantage of it. The demonstration programs in Figures 3 and 4 require about 115 bytes above RAMTOP, but so that you can try out larger applications, reserve 156 bytes above RAMTOP by typing POKE 16388,100 and ENTER, then POKE 16389,67 and ENTER, then NEW. If you have additional memory, you may want to reserve several hundred bytes at the top of your RAM. LOAD "VARIABLES TRANSFER" and type RAND USR 16514. The USR 16514 entry calls the block C routine. Look again at Figure 2 and convince yourself that block C transfers block D from the addresses shown in column 2 to the addresses shown in column 3, the Operating Addresses (note that the DE register pair is loaded indirectly from the systems variable; 4004h = 16388d). The Variables Transfer routine is now safely above RAMTOP, and you should type NEW to clear out the memory.

Figure 3.

```
  1 REM CRAMTOP
 10 DIM A(3)
 20 DIM A$(3)
 30 LET P=PEEK 16388+256*PEEK 1
6389
 40 PRINT "HAVE YOU RESERVED AT
 LEAST#";USR P-P;"##BYTES ABOVE
RAMTOP?"
 50 STOP
 60 PRINT "A(3)","A$(3)"
 70 FOR N=1 TO 3
 80 INPUT A(N)
 90 PRINT A(N),
100 INPUT A$(N)
110 PRINT A$(N)
120 NEXT N
130 RAND USR (P+54)
140 PRINT "NOW TYPE NEW, THEN L
OAD RESTORE."
```

Figure 2.

Loading Addresses	REM Statement Addresses	Operating Addresses	Object Code	Instruction	Comment	Blocks
17302			015C00	LD BC,#bytes	005Ch=92d	
17305			118240	LD DE,dest'n	4082h=16514d	
17308			21A243	LD HL,source	43A2h=17314d	A
17311			EDB0	LDIR	blk B transfer	
17313			C9	RET	return	
17314	16514		014F00	LD BC,#bytes	004Fh=79d	
17317	16517		218F40	LD HL,source	408Fh=16527d	
17320	16520		ED5B0440	LD DE,(dest'n)	4004h=RAMTOP	C
17324	16524		EDB0	LDIR	blk D transfer	
17326	16526		C9	RET	return	
17327	16527	RAMTOP	DDE5	PUSH IX	save initial IX	
17329	16529	+2	2A0440	LD HL,(4004)	RAMTOP in HL	
17332	16532	+5	E5	PUSH HL	HL to IX	
17333	16533	+6	DDE1	POP IX	RAMTOP in IX	
17335	16535	+8	014F00	LD BC,004F	004Fh=79d	
17338	16538	+11	09	ADD HL,BC	addr.of blk Z	H
17339	16539	+12	DD753A	LD (IX+3A),L	dest'n to blk F	
17342	16542	+15	DD743B	LD (IX+3B),H	dest'n to blk F	
17345	16545	+18	DD754A	LD (IX+4A),L	source to blk G	
17348	16548	+21	DD744B	LD (IX+4B),H	source to blk B	
17351	16551	+24	E5	PUSH HL	save addr.blk Z	
17352	16552	+25	2A1440	LD HL,(4014)	4014h=E_LINE	
17355	16555	+28	ED4B1040	LD BC,(4010)	4010h=VARS	
17359	16559	+32	ED42	SBC HL,BC	E_LINE-VARS	
17361	16561	+34	2B	DEC HL	variable space	I E D B
17362	16562	+35	DD7537	LD (IX+37),L	#bytes to blk F	
17365	16565	+38	DD7438	LD (IX+38),H	#bytes to blk F	
17368	16568	+41	DD7543	LD (IX+43),L	#bytes to blk G	
17371	16571	+44	DD7444	LD (IX+44),H	#bytes to blk G	
17374	16574	+47	C1	POP BC	addr.of blk Z	
17375	16575	+48	09	ADD HL,BC	last addr.blk Z	J
17376	16576	+49	E5	PUSH HL	HL to BC	
17377	16577	+50	C1	POP BC	last addr.blk Z	
17378	16578	+51	DDE1	POP IX	restore intl.IX	
17380	16580	+53	C9	RET	gives end blk Z	
17381	16581	+54	010000	LD BC,#bytes	variable space	
17384	16584	+57	110000	LD DE,dest'n	addr.of blk Z	
17387	16587	+60	2A1040	LD HL,(source)	4010h=VARS	F
17390	16590	+63	EDB0	LDIR	blk transfer	
17392	16592	+65	C9	RET	return	
17393	16593	+66	010000	LD BC,#bytes	variable space	
17396	16596	+69	ED5B1040	LD DE,(dest'n)	4010h=VARS	
17400	16600	+73	210000	LD HL,source	addr.of blk Z	G
17403	16603	+76	EDB0	LDIR	blk transfer	
17405	16605	+78	C9	RET	return	
		+79		The size of this block is user defined. It is the area used for variable storage above RAMTOP, safe during NEW, LOAD, and CLEAR.		Z

Trying the Application Program

Enter the sample application program in Figure 3 (named in reference to the fact that I am still working with a 1K machine). When you RUN this program, line 40 checks to see how big the variables are that you set aside in *earlier* lines and asks you to confirm that there is sufficient space above RAMTOP for this amount of variable space, and in addition, for the Variables Transfer routine, block D. Because the routine in line 40 uses a set of registers that are also used for generating the display, some users have found that they must run the machine in FAST mode to avoid crashing the system. Conservative advice would be to add the following lines:

35 FAST
45 SLOW

The variable space above RAMTOP will be referred to as block Z from now on. Line 40 also lets you determine which variables will be transferred, although nothing is transferred as of yet. Arrays DIMensioned in earlier lines, such as A(3) and A$(3), and simple variables such as P will be transferred while variables introduced in later lines, such as N in line 70, will not be transferred.

RUN the program, confirm that you have reserved adequate space, then type CONTinue and ENTER. The screen will prompt you for a number and then a letter. This will happen three times for a total of six items. Enter anything you like,

or just type 7 and ENTER, X and ENTER, 8 and ENTER, Y and ENTER, 9 and ENTER, Z and ENTER. You have now loaded the arrays that were DIMensioned in lines 10 and 20, and the computer has now transferred those two arrays and the variable P to block Z. The transfer was executed by line 130, RAND USR (P3+4) which calls the block transfer routine in block F. Look again at blocks F and G in Figure 2. Block F transfers variables and arrays into block Z, and block G transfers block Z back down into the variables area of the same, or a different, Basic program.

The screen should now be telling you to type NEW and ENTER, then LOAD and "RESTORE", the program in Figure 4, so go ahead. You may actually want to SAVE "CRAMTOP" first for future reference. Note that the first three lines of RESTORE are identical to the first three lines of CRAMTOP. This is a necessity because space must be created in a Basic program before information can be transferred from block Z into the program. Line 40, RAND USR (P3+6) then calls the block G routine which performs the transfer. The rest of the program simply prints your arrays. RUN the program. If you entered 7, X, 8, Y, 9, Z, in CRAMTOP, these numbers should now appear. If they do not appear, recheck

Figure 4.

```
  1 REM RESTORE
 10 DIM A(3)
 20 DIM A$(3)
 30 LET P=PEEK 16388+256*PEEK 1
6389
 40 RAND USR (P+66)
 50 PRINT "A(3)","A$(3)"
 60 FOR N=1 TO 3
 70 PRINT A(N),A$(N)
 80 NEXT N
```

Figure 5. Sample Calculations of the Bytes Used to Store Three types of Variables.

Variable Type	Bytes Used
Simple Variables	
LET P=	1+5
LET PI=	2+5
LET POP=	3+5
Numerical Arrays	
DIM A(m)	1*2+4+5*m
DIM A(m,n)	2*2+4+5*m*n
DIM A(m,n,p)	3*2+4+5*m*n*p
Character Arrays	
DIM A$(m)	1*2+4+m
DIM A$(m,n)	2*2+4+m*n
DIM A$(m,n,p)	3*2+4+m*n*p

RESTORE, then SAVE it, then recheck CRAMTOP, and, if neither of these programs contains an error, go back to square one. If you made it this far successfully, you deserve a round of applause.

The Steps of the Variable Transfer Routine

Let me now summarize the steps you must go through to use the Variables Transfer routine in your own applications.

1) You must decide how much space you need to reserve above RAMTOP. Figure 5 contains formulas that are likely to be useful for this. In the case of CRAMTOP, A(3), A$(3), and P take up 21 +9 +6=36 bytes. Add this to the 79 bytes required to hold block B, and you will understand why CRAMTOP asked you if you had reserved at least 36+79=115 bytes. Reserve adequate space above RAMTOP (see chapter on the organization of memory or storage in your manual).

2) LOAD the Variables Transfer routine, then type RAND USR 16514 and ENTER to transfer it above RAMTOP.

3) DIMension arrays and assign variables that you will later want to transfer at the beginning of your Basic program as we did in CRAMTOP.

4) Call the block E routine, USR P, as we did in line 40 of CRAMTOP. There are several ways you can do this to obtain slightly different information.

PRINT USR P gives the last address in block Z. This must be smaller than the last address in your RAM, of course, or else you will lose your data.

ARIES

SPACE SIMULATION GAMES

ZX-81/TIMEX 1000 16K

BLACK HOLES

NAVIGATE YOUR STARSHIP THRU GRAVITATIONAL FIELDS OF FOUR BLACK HOLES TO REACH YOUR HOME PLANET SAFELY
A NEW SITUATION EVERY TIME

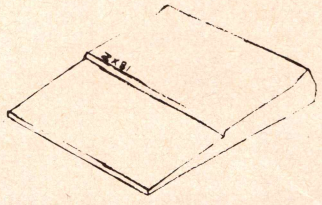
LINK UP

LAUNCH YOUR SHUTTLE AND CONTROL ROCKET BURNS TO LINK UP WITH SKYLAB. ACTUAL SIMULATION OF GRAVITATIONAL FIELDS, TRUE ELLIPTICAL ORBITS, DISPLAY OF ORBITAL PARAMETERS, AND CHOICE OF DISPLAY MODES

BOTH GAMES ON ONE CASETTE $12.00
SEND CHECK OR MONEY ORDER TO:

ARIES ASSOCIATES
511 MARY AVE.
HUNT. VALLEY, PA 19006

16K INSIDE?!!



No Bulky Add-ons!
Leaves back connector free for printer or peripherals!
Inexpensive using your parts.
Can be assembled and installed by anyone who can use a soldering pen. Complete instructions, including schematic, parts list, suggested Board layout, assembly and installation. $7.95
With optional pre-made P.C. Board, ready for assembly. $18.95 from:

Independence Research
P.O. Box 1497
Orem, Utah 84057

PRINT USR P-P gives you the number of bytes that you must reserve above RAMTOP, as in line 40 of CRAMTOP.

PRINT USR P-P-79 gives you the number of bytes required in block Z, and thus allows you to check your calculations from Figure 5.

One of these three choices must go in a line like line 40 of CRAMTOP, even if you already know the answer it will return, because USR P sets up blocks F and G for the transfer.

5) Use any other variables that you need to in your Basic program after you call USR P. These will not be transferred. Then call USR (P3+4) once the arrays that you want to transfer are filled.

6) LOAD the program that you want to transfer your variables to, and DIMension arrays and assign variables at the beginning of the program that you wish to restore to the program. Do not forget P. Then, before any other variables are introduced in the program listing, insert a line containing RAND USR (P3+6). See the RESTORE program again if you are confused about this step. When you RUN the program, your arrays and variables will be written in from block Z.

Protecting Your Variables

RUN, CLEAR, LOAD, and NEW all possess the ability to erase variables that it may have taken you hours to type into the machine. You can employ one safety measure in the portion of any Basic program that serves to load a large array. You add a line which calls USR (P3+4) after each data point is entered. Each time that you call USR (P3+4) the data previously transferred will be written over identically, and the current entry will be added to block Z. Then if you hit one of the four functions above, just type RAND USR (P3+6) and the data will be restored. In the case of NEW, you will, of course, have to load your Basic program over again before restoring the data.

For example, add this feature to CRAMTOP by moving line 130 into the FOR-NEXT loop. Type 115 RAND USR (P3+4) and ENTER. An occasional SAVE is also a good idea to protect your data from power failures.

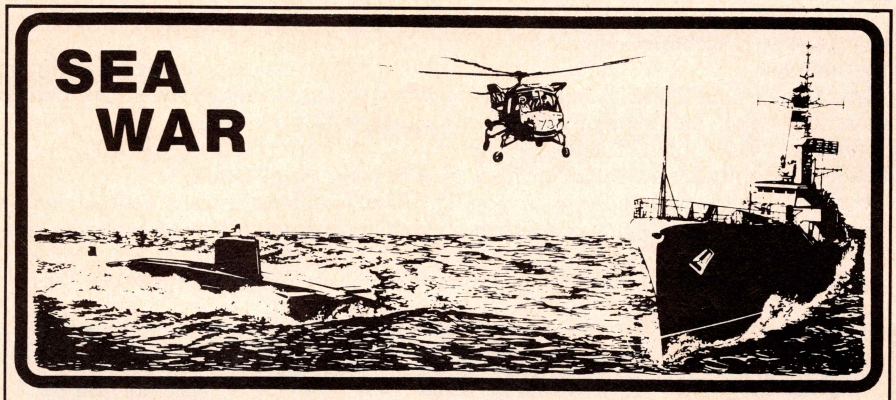
If you think you have the hang of Variables Transfers, you are now ready for your next crack at machine language.

The Problem of Fixed Addresses

Many machine language routines for the Sinclair computer are written so that they will work properly only if they are located at a fixed starting address. This might at first seem to be a requirement in programs which draw upon specific addresses within the routine for the information stored at those addresses. A fixed starting address might also seem necessary in a program in which one subroutine in the program (block E) is used to rewrite other subroutines within the program (blocks F and G). Let's see how the Variables Transfer routine can modify itself so that it can be used at any location in memory.

First, look at the first instruction in block F, LD BC, #bytes. While claiming to load BC with the number of bytes in the variables space of a Basic program, the four zeros in column 4 show that in actuality BC is only loaded with zero, that is, if block E, i.e., USR P, is not called prior to calling block F, i.e., USR (P+54). How does block E change those four zeros to the number of bytes to be transferred?

The four zeros make up the two bytes at RAMTOP + 37h and RAMTOP + 38. Confirm this with column 3 (37h = 55d and 38h = 56d). Now look at block I. Block I subtracts VARS from E LINE then decrements the result to obtain the amount of variable space that you want to transfer when you call block E (i.e., USR P) (see the chapter on system variables in your manual). The amount of variable space is now sitting in the HL register pair. Because the IX register was loaded earlier with RAMTOP, the next two instructions, LD (IX+37),L and LD (IX+38),H rewrite the two bytes that we just discussed in block F. Now block F truly contains the number of bytes to be transferred. Four instructions in blocks F and G appear to load a register pair with zero. Actually, block H writes the destination into block F and the source into block G, then block I writes the number of bytes into blocks F and G. Block J puts the last address in block Z into the BC



SEA WAR
FOR ZX81

This game is designed for one or two players. Each player has three submarines. As a certain number of points are reached, bonus submarines will be given. When the game is going on, the higher the score you get, the more that hostile features will appear on the screen.

The features which appear on the screen are as follows:
Submarine, Warship, U-boat and Helicopter.

Submarine

This feature is under your own control and is loaded at the left hand side of the screen. The keys '9' and '0' are the firing buttons for the upward missiles and forward missiles respectively.

The submarine can be moved in four directions; it can move upwards and downwards by pressing keys '7' and '6' respectively. In order to move forward, you press key '8' and it will draw back to its previous position when you release the button. Also, the submarine can be moved diagonally upwards or downwards by pressing both keys '8' and '7' or keys '8' and '6' respectively at the same time.

U-boat

This is the hostile submarine: It drifts under the sea level randomly, from right to left. Missiles are fired as it approaches your submarine. Destroying a U-boat scores 20 points.

Warship

This is the enemy destroyer which will release bombs diagonally as it drifts on the sea surface from right to left.

The destruction of a warship is done by either firing a vertical missile or, when the submarine is just under sea level, by pressing keys '7' and '0' which release a horizontal missile. Otherwise the missiles will just pass under the ship bottom. Each destruction of this feature scores 50 points.

Helicopter

As you reach a certain score, helicopters appear on the left hand corner of the screen; they drop vertical bombs as they hover above the submarine. To destroy the helicopters, vertical missiles can be fired by pressing key '9'. Each helicopter destroyed scores 100 points.

*New Game—ADDER—Arcade-type game.
Shoot the numbers as they pass across the screen, but watch your total.

Each game $9.95 plus $2.00 postage/handling
Distributor Inquiries Welcome

Panda Software,
51 Elgin Street, Shelton
Stoke-on-Trent ST4 2RD, England

register pair so that this information is returned to you when you PRINT USR P.

Although I said that the Variables Transfer routine can be used at any starting address, the use of the IX register just described above forces one qualification on that statement. The Variables Transfer routine can be used at any starting address *provided that its starting address is RAMTOP.* Rather than loading RAMTOP into the IX register, we could have the program discover its own starting address by reading the program counter, and then load that address into the IX register. This would free us from the above qualification. I will leave the method by which one transfers the contents of the program counter to the IX register as a puzzle for those of you who write machine language. (The answer will appear at the end of this article.)

Suggestions to Machine Code Programmers

The Sinclair and Timex/Sinclair computers are serious computers, and their usefulness will be limited only by the quality of the software available for them. Therefore, I suggest that those of you who write machine language routines write them so that they can be used at any location in memory.

To return now to practical matters, Sinclair cautions us that a USR routine should not disturb the IX register if compute and display is operating. In spite of this caution, I have failed to crash my system yet. Conservative advice would be to run the machine in the FAST mode when you are dealing with a questionable situation like this one.

Figure 6.

```
Add these lines
   1 REM MC ARRAYS
 100 DIM Z(m)
 110 LET P=PEEK 16388+256*PEEK 1
6389
 120 PRINT "AT LEAST#";USR P-P;"
#BYTES ABOVE RAMTOP?"
 130 STOP
 285 RAND USR (P+54).

Change line 280 to,
 280 POKE PEEK 16400+256*PEEK 16
401+6+V,16*CODE (H$)+CODE (H$(2)
)-476
```

A Mystery Application

The Variables Transfer routine can be used to compile machine language routines for use in a single Basic program. All you need is a loading program that places your machine language in an array. This is easily obtained by adding and substituting a few lines in Figure 1.

Make the changes in Figure 1 that are shown in Figure 6. The number, m, should be large enough that 5 * m is greater than or equal to the number of bytes in your routine. If Z(m) is the first array held in block Z, then the starting address of your machine language routine is RAMTOP + 85 in block Z and

PEEK 16400+256*PEEK 16401+6

in the variables area of your Basic program. PEEKing the contents of the machine language that you enter will be easier from its block Z addresses because the variables space below RAMTOP moves around quite a bit.

When modifying Figure 1, set m in line 100 equal to 4. This provides you with 4 * 5 = 20 bytes of space. RUN the modified program, then type CONTinue. Figure 7 contains a routine which returns the number of unused bytes below RAMTOP. (This was written by Dr. Ian Logan and is reprinted here with the kind permission of *SYNTAX ZX80*, RD2 Box 457, Harvard, MA 01451.) Enter the bytes in Figure 7 (i.e., 2A and ENTER, 1C and ENTER, and so on). Then type END and ENTER. To find out how much unused memory you still have below RAMTOP, type PRINT USR (P+85) and ENTER. The number 204 should appear at the top of your screen if you are working with a 1K machine. As you can see, there is not much space left. On the other hand,, you do not need much memory to have fun with machine language!

Figure 7.

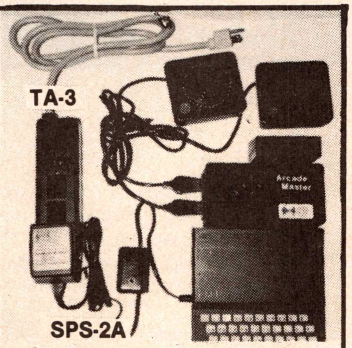
```
Dr. Logan's Bytes Remaining
          Sequence
2A,1C,40,CD,CB,0E,E5,C1,21,14,
   00,00,ED,42,E5,C1,C9
```

Congratulations if you have made it through this article. If you have a useful program or two, and in addition, a few points to puzzle over, then we have both succeeded.

The Answer to the Puzzle

When you CALL a subroutine from within a machine language routine, the program counter is pushed onto the stack. The first instructions in the subroutine should then be POP IX, PUSH IX . . . etc. RET. When the main program is returned to, the IX register will contain the address of the instruction following the CALL instruction in the main routine. For the sake of simplicity, we can have the subroutine decrement the IX register so that it contains the starting address of the main

SOUND EFFECTS
MUSIC GENERATION
TWO 8 BIT I/O PORTS —
DUAL ATARI JOYSTICK CONTROL



The ARCADE MASTER Plug-in Module for Zx81 and TS1000
KIT $54.95 • A&T $64.95 • PC Board $24.95
Now you can create complex arcade quality sound effects, write melodies in 3 part harmony, and control the action with one or two Atari Joysticks *(not included)*

- 3 tone generators - 8 octive range
- 3 channel mixer, amplitude controller, and envelope generator
- Noise generator
  ALL INDEPENDENTLY PROGRAMMABLE!
- Internal speaker, volume control, and audio output jack
- Requires no additional power supply
- Complete instruction manual & examples
- Can be used with printer, 16K rampak, and most other modules
- Memory mapped so it can easily be programmed in basic using peek & poke
- User selectable to the start of any 4K memory location
- 2 Independent, TTL compatible I/O ports can be used as general purpose input/output, or with joysticks

2 AMP POWER SUPPLY
ZX80/81 • TIMEX 1000 • MICROACE
As you expand your system, you'll need more power to run it.
This supply has it!
SPS-2A -- Power Supply -- $19.95

MULTIPLE OUTLET STRIP
with built in
TRANSIENT ABSORBER
PROTECTS YOUR COMPUTER SYSTEM FROM DANGEROUS VOLTAGE SPIKES
Absorbs transients and surges such as those produced by lightning, switching surges and noise spikes. 3 protected A.C. outlets, 15 A. fuse, power switch & pilot light. 6 ft. cord
TA3 -- TRANSIENT ABSORBER -- $26.95

Send check or money order to:
HURRICANE ELECTRONICS • P.O. Box 87 • Dolton, IL 60419
Include $2.50 shipping/handling per order -- Ill. residents add 6% tax

routine upon return to the main routine. To preserve the contents of the IX register through all of this, the first instruction in the main routine should be PUSH IX. Then, CALL the routine immediately. At the end of your main routine, do not forget to POP IX.

Figure 8 shows a subroutine that will put the starting address of a main routine from which it is called into the IX register on return. The main routine must begin with PUSH IX, CALL 16514, as above.

Figure 8.

Address in REM statement	Hex object code	Decimal object code	Instruction
16514	DD,E1	221,225	POP IX
16516	DD,E5	221,229	PUSH IX
16518	06,05	006,005	LD B,5
16520	DD,2B	221,043	DEC IX
16522	10,FC	016,252	DJNZ e
16524	C9	201	RET

To implement this routine with a version of the Variables Transfer routine, VAR PLUS, load the bytes in Figure 8 into the test program in Figure 9 and SAVE the result.

Now LOAD the Variables Transfer routine, but do not type RAND USR 16514. Just leave it in the REM statement. POKE in the changes that are shown in Figure 10, (i.e., POKE 16520,0 and ENTER, POKE 16521,17 and ENTER, and so on). Add the lines in Figure 11, and you have a program that prompts you for a starting address, and then locates itself there. Be sure that you have plenty of space above RAMTOP, then RUN the program. For the test program in Figure 9, you should enter 17252 when the screen prompts you. RAMTOP must be smaller than this.

LOAD the test program and RUN it. The screen should show the following:

INITIAL A10
ALTERED A1
RESTORED A10

Note that any program that uses the IX register in the manner that the modified Variables TRansfer routine (VAR PLUS) does, can use the Figure 8 routine to locate itself. Thus one routine must remain tied to an address while the others go free. ■

Figure 9.

```
 1 REM XXXXXXXXXXX
10 LET P=17252
20 LET A=10
30 PRINT "INITIAL A=";A
40 RAND USR P
50 RAND USR (P+54)
60 LET A=1
70 PRINT "ALTERED A=";A
80 RAND USR (P+66)
90 PRINT "RESTORED A=";A
```

Figure 10.

REM Statement addresses	Hex changes	Decimal changes	Instruction
16520	00,11,00,00	0,17,0,0	LD DE,nn
16529	CD,82,40	205,130,64	CALL 16514
16532	DD,E5	221,229	PUSH IX
16534	E1	225	POP HL

Figure 11.

```
  2 REM VAR PLUS
 10 PRINT "ENTER THE ADDRESS TH
AT YOU WANT VAR PLUS TO BEGIN AT
"
 20 INPUT P
 30 POKE 16522,256*(P/256-INT (
P/256))
 40 POKE 16523,INT (P/256)
 50 RAND USR 16514
 60 PRINT "P IN YOUR APPLICATIO
NS MUST NOW =#";P
```


practical software

FOR THE SINCLAIR ZX80/81 (8K/16K)

WALL STREET
• Strategy game for 1-3 players based on the ups and downs of the Stock Market

TRIPLE JOTSEE
• Game of luck and strategy for 1-6 players with all the excitement of dice rolls.

SPECIAL INTRODUCTORY PRICE $9.95 EA.
Regular price $14.95 ea.

ZX INVENTORY
• STORAGE OF 200 ITEMS AND PRICES
• PRINTING CAPABILITY (ZX81)
• COMPREHENSIVE SEARCH ROUTINES

ZX DIRECTORY
• SORTS FILES ALPHABETICALLY
• STORAGE OF 60 FILES (16K)
• PRINTING CAPABILITY (ZX81)
• COMPREHENSIVE SEARCH ROUTINES

BOTH PROGRAMS EASILY MODIFIED TO STORE MORE FILES WITH LARGER RAM PACK.

ONLY 19.95 EA.
BOTH PROGRAMS FOR 34.95

SEND CHECK OR MONEY ORDER TO:

SERVITRONICS
P.O. BOX 2024, HARTFORD, CONN. 06145
FOR INFORMATION OR VISA OR MASTERCARD ORDERS
CALL (203) 643-7900 SHIPPING U.S. $1.50 OUTSIDE U.S. $3.00
dealer enquiries welcome

COSMONICS

FOR THE ZX81 AND TS1000 COMPUTERS

TIRED OF SAVING 16K OF PROGRAM JUST TO SAVE 2K OF DATA?

The COSMONICS READ/WRITE UTILITY will allow you to save ONLY what you want to save---from strings, arrays, or a location in memory---onto a cassette. You can read it back when you want to use it. This data can be used by the same program or by different programs.

The COSMONICS READ/WRITE UTILITY can also make it easier for you to translate programs which are written for other computers in BASIC, and which have "WRITE to cassette" and "READ to cassette" statements. This use of the utility can greatly increase the amount of software available to you.

The COSMONICS READ/WRITE UTILITY is easy to use, and it loads easily. The instructions are clearly written, and a short sample program which demonstrates it's use is is included. The routine occupies approximately 500 bytes, and requires a minimum of 2K RAM.

The COSMONICS READ/WRITE UTILITY is now available for $17.00 + $1.50 postage and handling. Calif. residents, please add 6% or 6.5% sales TAX.

Send self-addressed, stamped envelope for FREE catalog.

COSMONICS
P.O. Box 10358, San Jose, CA. 95157

VOTEM

$39.95 (KIT)
$59.95 (A&T)

ANALOG INTERFACE FOR THE ZX81

Welcome your computer to the "real world" of analog signal processing. VOTEM is a complete package, consisting of the necessary hardware and software to enable your computer to measure voltages and temperatures. VOTEM also includes circuitry that conditions the tape signal for dependable LOADs.

- Software compatible with Timex TMS-1000, Sinclair ZX81/80-(8K)
- Requires absolutely no modifications to computer
- Measures voltages and temperatures
- Probe provided for air and liquid temperature measurements
- Resolution is better than 14 bits (0.00005V or 0.04 degrees C)
- Voltage range of +1V can be expanded with on-board resistors
- Low power, requires less than 20mA at +11V unregulated
- Can be powered from computer's supply (cable included)
- Tape signal conditioning circuitry
- Tape signal monitoring capability (audio and visual)
- Manual includes detailed kit assembly and calibration
- Software for calibration and applications fits in 1K RAM
- Instructions for adapting to other Z80 computer systems
- Compact, 1" by 4" by 3"

Also, static RAM chips, 6116P-3 (2K by 8) with instructions for upgrading Sinclair ZX81 computer from 1K to 2K. Only $11.95 each. Send check or money order. Include $3 shipping and handling.

Down East Computers
P.O. Box 3096
Greenville, NC 27834

WANTED:

Creative/innovative ZX81/TS1000 "Pros" to independently develop software for national retail distributor. Z-80 machine language capabilities a plus. Generous royalties.

Send name, phone number, and qualifications to:

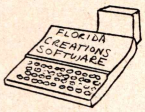
TIME WORKS INC.
P. O. Box 321
Deerfield, IL 60015

All qualified respondents will be contacted.

FLORIDA CREATIONS PRESENTS:

SINCLAIR
SOFTWARE
★ CHEAP ★

» GAMES
» HOME
» BUSINESS
» TECHNICAL ARTICLES

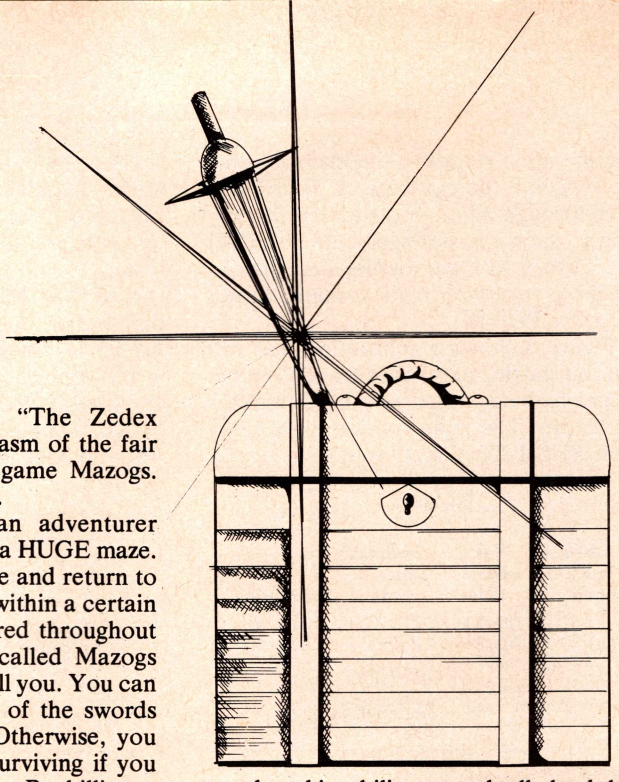


ZX-81 and TS 1000
1k through 16k memory
MOST PROGRAMS 50 CENTS EACH OR LESS

Catalog & two sample programs for $1 and SASE

FLORIDA CREATIONS, DEPT. SC3 , P.O. BOX 16422, JACKSONVILLE, FL, 32245

****SATISFACTION GUARANTEED******
(Not a part of Sinclair Research)

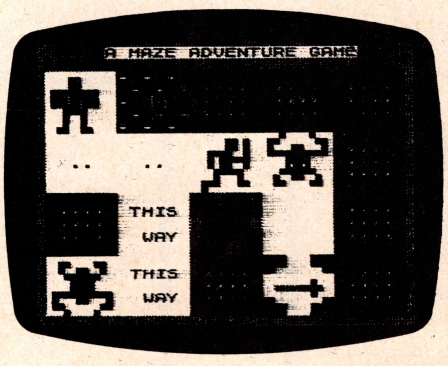


Mazogs

David Grosjean

Jim Beloff reports in "The Zedex Microfair" on the enthusiasm of the fair goers for the adventure game Mazogs. We share that enthusiasm.

In Mazogs you are an adventurer searching for a treasure in a HUGE maze. You must find the treasure and return to the entrance of the maze within a certain number of moves. Scattered throughout the maze are creatures called Mazogs whose job is to stop and kill you. You can kill them if you find one of the swords lying around the maze. Otherwise, you have a 50/50 chance of surviving if you get into a fight with one. By killing a Mazog you increase the number of moves you have. Also scattered throughout the maze are prisoners (trapped in the walls) who tell you which way to go, but their directions will take you only a short distance.



Certain commands help you in the search, but each one costs you moves. E.g., a "view" shows a larger view of the maze than the 20 spaces normally shown; a "status report" tells how many moves are left, how many moves to the treasure, and how many moves the various commands cost. A sword can be bought, but at a very high price—half of your moves. You can quit the game, and the computer will tell you how far you got.

After starving to death (running out of moves) or successfully returning to the entrance with the treasure, you can look at the maze which is four screens large. At this point the computer will print the solution. With three levels, it can keep you interested for hours on end.

This game is outstanding because of its mixture of complexity and simplicity, its speed, and its ability to gradually lead the player up to a difficult game. It is a program written mostly in machine code but there is quite a bit of Basic, too. The game is rather long and takes about five minutes to load. We had no difficulty in loading it. The documentation is good, and the use of graphics is especially impressive (see sample run). The treasure seeker and the Mazogs are not tokens moving in the maze, but full fledged figures with limbs that actually move. The size of the pixels on the Timex/Sinclair computers gives rather large figures, but they do move as the game is played. Just watching the graphics is fascinating.

In short, Mazogs is an excellent graphics adventure program. and lives up to the publisher's promise of being a game "unlike any other game you've seen on the ZX81." ■

David Grosjean, 50 Kings Rd., Chatham, NJ 07928.

SYNC

SOFTWARE PROFILE

Name: Mazogs

Type: Fantasy Game

System: 8K ROM; 16K RAM

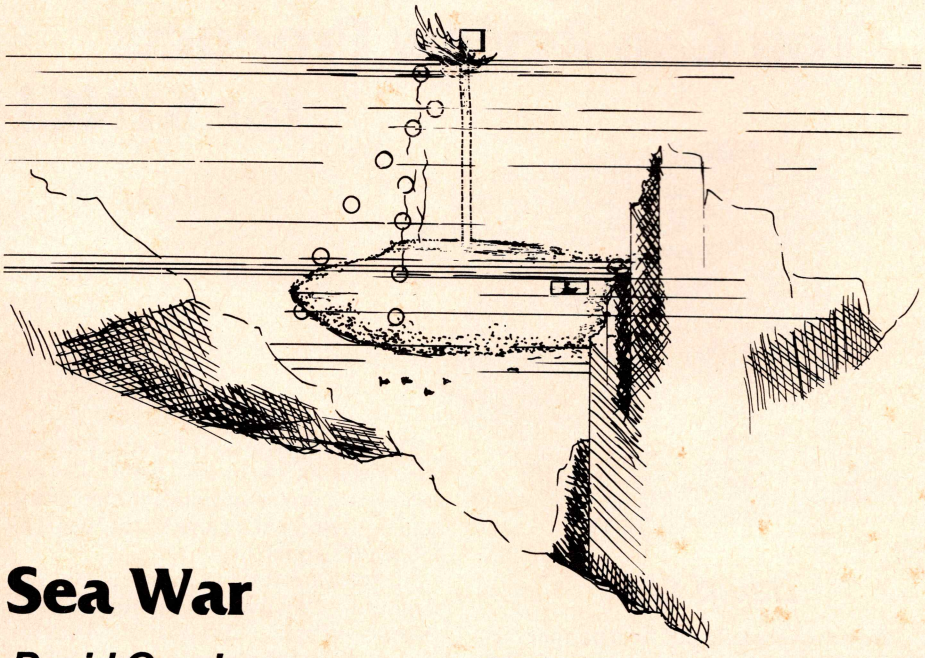
Format: Cassette

Summary: Outstanding because of its mixture of complexity and simplicity, its speed, and its ability to lead the player.

Price: £10

Manufacturer:

Bug-Byte
Freepost
Liverpool L3 3AB
United Kingdom



Sea War

David Grosjean

Sea War is another excellent fast action graphics game that was a hit at the Microfair.

The game starts by scrolling from right to left a very impressive "title page" asking for the number of players (the limit is 2). A rather large ship then travels across the surface of the water and drops your submarine into the water; then the action starts. You are now in a submarine just below the surface of the water, and you have to destroy U-boats, warships, and helicopters, all of which are capable of destroying you. The water surface is constantly moving, and, of course, enemy shots are constantly assailing you.

Five keys provide the controls—up, down, forward (you drift back if your finger is off the key), fire up, and fire across. You must destroy the helicopters by firing up, the warships by either firing across or up, and the U-boats across. Helicopters count 100 points, warships 50 points, and U-boats 20 points. You begin the game with three subs, and you can get additional subs when your score reaches 1000, 4500, and various scores on up.

The use of graphics in this game is astounding. The action is quite fast (it is all machine code) and a little difficult to get used to. This is a sign of a good game—you cannot get bored easily unless you are also easily frustrated. Later in the game the attackers, mainly the subs, practically cover the screen with shots, and this is when the game gets very hectic.

This game is best played with a full keyboard, but the Sinclair keyboard is adequate. The only major problem with this program is that every now and then the program crashes (and it seems that this is always during the best game!).

In conclusion, this is the best "shoot 'em" game that I have seen for the ZX81. It is a fast-paced game which keeps the player's interest. The graphics are, as I have said, astounding. The most notable features are the helicopters and the player's death scene. I strongly recommend this game to any arcade game fan who likes a challenge, and the price is nice at $10. ■

David Grosjean, 50 Kings Rd., Chatham, NJ 07928.

SYNC

SOFTWARE PROFILE

Name: Sea War

Type: War game

System: 8K ROM; 16K RAM

Format: Cassette

Summary: Fast-paced, astounding graphics; the best shoot 'em game I've seen for the ZX81

Price: $9.95 plus $2 s&h

Manufacturer:

Panda Software
51 Elgin St. Shelton
Stoke-on-Trent ST4 2RD
United Kingdom

PUT YOUR TIMEX/SINCLAIR COMPUTER TO WORK!

TIMEX/SINCLAIR SOURCEBOOK™

- **SOFTWARE**
- **HARDWARE ADD-ONS**
- **BOOKS/CATALOGS**

Maximize your ZX80, ZX81 or TS1000 computer investment with the TIMEX/SINCLAIR SOURCEBOOK which lists programs, hardware accessories and reference books.

The SOURCEBOOK allows you to quickly identify the ZX computer products you need from a wide variety of sources to put your computer to work. Order your copy today — only $6.95

TIMEX/SINCLAIR SOURCEBOOK™
Micro Design Concepts
Dept. SC-5
P.O. Box 280
Carrollton, TX 75006

Please send me the TIMEX/SINCLAIR SOURCEBOOK. I enclose $6.95 plus $1.25 P&H ($2.50 outside the U.S.) Add sales tax in Texas.

Name _____

Address _____

City _____

State/Zip _____

Have a product you would like listed?

☐ Check for an application for free listings.

White T-shirts with red & black lettering.

S-34-36, M-38-40, L-42-44

$7.50ppd
Tx. residents
add
5% sales tax

Please give street address when ordering. Make check or money order payable to:

Pecos Star Co.
Box 8348
Denton, Tx. 76203

ATTO-SOFT
PRESENTS

ZX-MAN

ZX-MAN. Turn your **ZX81** or **TIMEX SINCLAIR 1000** into an arcade type game computer with **ZX-MAN.** 100% machine code makes this fast acting program as much fun as being at the arcades. With the joystick option you can have the real feel of game playing never before available for your **ZX81** or **TIMEX SINCLAIR 1000. 16K required..... $14.95**

JOYSTICK. With **ATTO-SOFT's JOY-STICK** your **ZX81** or **TIMEX 1000** can be turned into an arcade type computer allowing fast control over **ZX-MAN** and other type software. Requiring only six simple solder connections inside your computer. Also included is software to develop your own programs..... **$14.95**

(Please add $1.50 Postage and Handling. COD's add $2.00.)
Send check or money order to:

ATTO-SOFT
832 E. Third Street,
Galesburg, Illinois 61401
(309) 343-4114

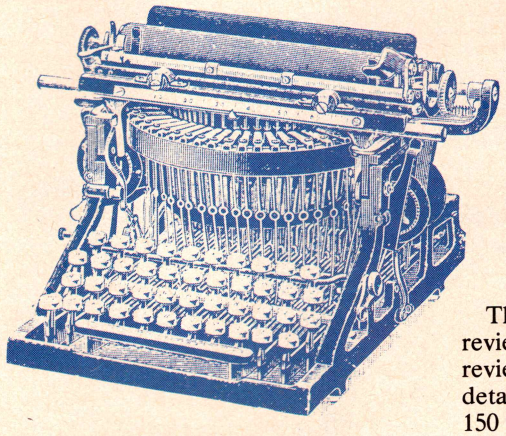
ATTENTION SINCLAIR ZX81 OWNERS!!!

Here's an inexpensive little book (Programming With The ZX81) that tells you how to use the features of that ZX81 you recently bought. It shows you programs that fit into the 1K machine and are still fun to use. Learn how the random number generator works and use it to simulate coin tossing and dice throwing. Look at the patterns the ZX81 graphics can produce. Animated graphics are also covered and complete programs for games such as Lunar Lander and Cannon Ball are included. Seven information packed chapters in this quality book. Order your copy today. Price is $5.75 postpaid in the US.

ELECTRONIC TECHNOLOGY TODAY INC. S-1
P.O. Box 83, Massapequa Park, NY 11762

☐ Send me my copy of "Programming With The ZX81"
☐ Send me your complete catalog
Price of Book including Postage $5.75
NY State Residents include Sales Tax _____
TOTAL ENCLOSED _____
Name_____
Address_____
City_____ State_____ Zip_____

Attention Readers: You Can Review Products for SYNC!



David Ahl

We are overwhelmed! New peripherals and software are coming out for the Timex/Sinclair computers at an astonishing rate. So fast, in fact, that our in-house reviewers can't keep up with it all.

Hence, we would like to invite readers to write reviews for us. Some products we receive here and will forward to qualified reviewers. However, for most reviews, we must depend upon you to write a review of a product you have purchased. (This, incidentally, is how you become a "qualified reviewer" and get a product forwarded from us.) Of course, we pay for all reviews.

A word about the review itself. It must be factual and objective. The biggest single group of people who read Ford ads are those people who have just bought a Ford. We all have a psychological need to justify a purchase. However, a product review is not an appropriate psychological outlet to justify a purchase. Nor is it the appropriate place to vent your passion against a manufacturer who has wronged you in some way.

Reviews should start with a brief description of the class of product (say modem or drill and practice software) including what it should do. Next should come a thorough description of the specific product being reviewed (no opinions yet). Next should follow your experience with the product: putting it together, using it the first time, using it later, and the reaction of others to it. Note the problems you met and the benefits that you have received from using it. It goes without saying that the product should be used in the environment for which it was intended.

The appropriate length for a product review is from 500 to 1000 words. Longer reviews are probably going into too much detail. A review of a game should be from 150 to 300 words long.

All software reviews must contain the standard Creative Computing/SYNC "Software Profile" information. That includes: name of. package, type, author, system and memory, format, a summary statement, price, and manufacturer's name and address.

We favor comparative reviews of three or four similar items over single reviews, but both are acceptable.

Pictures and illustrations are absolutely vital with a review or article. If we have to go to the manufacturer for a publicity shot or photograph the item here, it won't be nearly as effective as your photos. If you're not a photographer, find a friend with a 35mm SLR, load it up with TRI-X or Kodacolor 400 and shoot the item. Vary the angle and lighting. They won't all come out, but four or five usable shots out of 20 easily justifies the $7 or $8 for film and developing. We don't need 8 x 10 or even 4 x 5 prints; standard Fotomat 3 1/2 x 5 is fine. But they must be glossy finish; matte is not acceptable. The details important for your review should not be lost in the very light or very dark parts of your picture.

Illustrations should be done in black on white paper. Use India ink or a Pilot Razor Point equivalent. We prefer to use your illustrations than redraw things here.

Manuscripts must be typed double-spaced with generous margins. Other helpful suggestions for preparing your manuscript are contained in the article "Writing for SYNC." Send a self-addressed stamped envelope for a copy.

Please send all submissions to Paul Grosjean, SYNC, 39 E. Hanover Ave., Morris Plains, NJ 07950, and mark your envelope "Review." ■

HOT-Z

Victor Schiller

If you are looking for specialized software to help your endeavors into Z80 machine language, HOT Z will be the tool for you. HOT Z, available from Sinware, can be used with the 16K, 32K or 64K ZX81 or TS1000. There are both low memory (16K) and high memory versions available (32K & 64K).

HOT Z sets out to be your guide through the 32,768 memory locations in the expanded TS1000/ZX81, but it does more than that! HOT Z not only lets you enter maching language (ML) commands directly into RAM locations (much like entering Basic), but it also lets you test your ML routines one step at a time, while displaying register values.

SYNC

SOFTWARE PROFILE

Name: Hot Z

Type: Machine language assembler

System: 8K ROM (4K ROM available); 16K RAM; 32K RAM

Format: Cassette and manual

Summary: At any price, HOT Z would be a bargain, but at $20 it is truly affordable. A valuable tool for the machine language pro or novice.

Price: $19.95

Manufacturer:

SINWARE
Box 323
Dixon, NM 87527

Modifications can be entered easily by using a special edit mode. Provisions have been made to allow you to use floating points operations already programmed into the RAM, and smooth fast 24 line displays are used at all times.

HOT Z includes a user aids program and a concise, well-written manual. The user aids will acquaint you with the commands you can use and will label various ML routines.

Other functions of the HOT Z software are: Selective SAVEing and LOADing of memory blocks, and block transfers of sections of ML. Inserting and deleting ML commands is easily accomplished. Routines can be labeled and those labeled can be used as destinations for branching commands. You can also find a routine by using the search command and entering the label name. HOT Z converts from infamous HEX to decimal and back at the push of a button. ML mnemonics used are displayed. You enter the decimal or HEX code for an ML command and the mnemonic is automatically displayed in its own column.

For the ML neophite, HOT Z will greatly simplify your adventures into machine language, although the second paragraph in the manual states:

"A minimum requirement for running HOT Z is some knowledge of the hexadecimal (or hex) number system, which uses the characters 0-9 and F-F as its 16 digits. By and large, the assumption is made that you, the new HOT Z owner, know something about Z80 machine code. If you do not, there is one indispensable peripheral device you should acquire: it needs no extra power or cables or connectors. It comes in several models and is commonly called a Z80 programming book. The one by Zaks (from Sybex) is useful, but those written specifically for the ZX are generally more simple. If you are learning, then use HOT Z as a blackboard to work out the exercises."

My suggestion is to purchase one of the good books on ML and read it over while awaiting delivery (2-3 weeks). By the time HOT Z arrives, you will be able to charge right in.

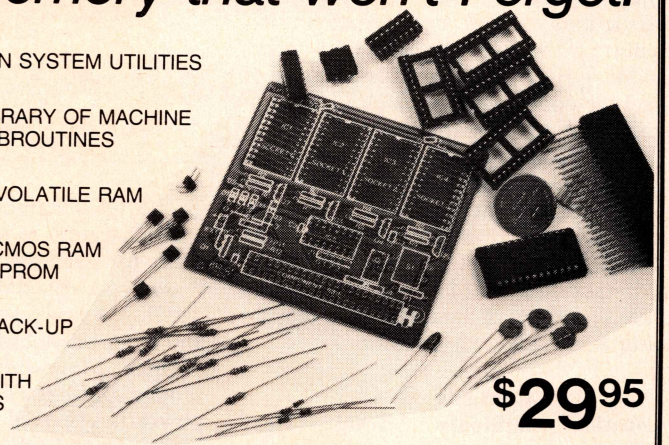
The more experienced ML programmer will find the use of HOT Z quite refreshing. The usual hassles of code entry, editing, and debugging are virtually eliminated. You will be free to concentrate more fully on code formulation. The "one step" feature will allow you to easily follow the detail of your program without risking a "crash." Much time will be saved by using HOT Z.

At any price, HOT Z would be a bargain, but at $20.00, HOT Z is a truly affordable software value. This package is a valuable tool for the machine language pro or novice. ■

Extend your ZX81 System: Add Memory that won't Forget!*

*or TIMEX 1000

- ADD YOUR OWN SYSTEM UTILITIES
- BUILD UP A LIBRARY OF MACHINE LANGUAGE SUBROUTINES
- UP TO 8K NONVOLATILE RAM
- USE HM6116P CMOS RAM OR 2716/2732 EPROM
- LOW POWER BACK-UP
- COMPATIBLE WITH 16K RAM PACKS



$29.95

This memory board is designed to fill the transparent 8K block of memory (from 8 to 16K) in a ZX81-16K system. The use of HM6116P 2K CMOS RAM memory IC's with their own reserve power supply means that routines stored in the RAM are nonvolatile — the RAM retains its memory even when the ZX81 is switched off or reset. Moreover, being RAM, the routines you store in the memory are easily modified.

With this board it's no longer necessary to place your machine language routines in REM statements, in string variables, or beyond RAMTOP. You can build up a resident library of machine utilities for use by your BASIC system.

Complete step-by-step instructions in a 14 page manual make assembly of the board easy. Construction takes between one and two hours. The kit (pictured above) is complete with a silkscreened solder-masked printed circuit board, all capacitors, resistors, transistors, sockets, connectors, integrated circuits, and the lithium cell. The board is supplied with one 2K CMOS 6116P-3 RAM — it will accomodate three more for a total of 8K.

Send check or money order for $29.95 plus $1.95 shipping and handling to the address below. The printed circuit board with the instruction manual is available separately for $15.00 post paid.

HUNTER, 1630 FOREST HILLS DRIVE, OKEMOS, MICHIGAN 48864

The Quicksilva Programmable Character Generator

Martin Wren-Hilton

The Quicksilva Programmable Character Generator: £26; Motherboard: £12; Edge Connector: £4. Quicksilva, 95 Upper Brownhill Rd., Maybush, Southhampton, Hants, U.K.

The Quicksilva Programmable Character Generator is a single circuit board which plugs into the QS Motherboard or the QS Edge Connector which plugs into the back of the ZX81. For the ZX80, a few small modifications are needed to connect it to the PCB.

Once installed, it lets the user program 128 different characters rather than the previous 64 and their inverses. After the board has been programmed, it can be LOADed with other programs which use the new character set.

The QS Character Board is operated by a small switch mounted on the side to show the normal characters or the programmed set. The board comes with comprehensive and easy-to-follow instructions as well as a demonstration cassette with two programs: CHR$ and L-CASE. CHR$ (1K) provides a series of machine code routines which make programming the board quite simple. L-CASE (3K) contains all the data for a complete lower case alphabet set.

At the moment, the ZX81 gets the information for displaying the characters from the top 512 bytes of the ROM, from addresses 7680 to 8191. Each character takes up 8 bytes of data. For example, the letter R is made up as follows:

Location	Contents in Binary	Total	Hex
8120	00000000	0	00
8121	01111100	124	7C
8122	01000010	66	42
8123	01000010	66	42
8124	01111100	124	7C
8125	01000100	68	44
8126	01000010	66	42
8127	00000000	0	00

Martin Wren-Hilton, 4 Little Poulton Lane, Poulton-Fylde, Blackpool FY6 7ET, U.K.

Figure 1.

```
100 LET L=USR SINC          ;Loads the normal character
                            ;set into the character RAM.
110 LET L=USR QLOAD         ;Loads the following characters
                            ;into character RAM.
120 REM E007C42427C444200   ;The first letter is the one
                            ;that you want to change and
                            ;the rest is Hex data for
                            ;the shape of the new
                            ;character.
130 REM STOP                ;Tells the computer that you
                            ;have finished LOADing new
                            ;characters.
```

The QS Character board represents each character in exactly the same way. Thus for example, if for some obscure reason you wished that the letter E looked like R, you would load the CHR$ program and enter the lines in Figure 1.

Once programmed, the characters remain until they are changed or the power is removed. However, when the LPRINT and COPY commands are used, the normal Sinclair characters are sent to the printer. To circumvent this problem, CHR$ has the routines QCOPY and QPRNT.

The uses of the character board are virtually limitless. Apart from the use of lower case to enhance programs, real "space invaders" can be easily created as well as more serious applications like circuit symbols and fine line drawings.

By combining a number of characters together in one block, the user can produce high resolution drawings. Figure 2 shows a couple of curves produced on the board. Figure 3 shows how to plot high resolution graphs on a 256 x 176 grid such as seen in Figure 2. To change the curves, simply change the equations in lines 120 and 140. Due to the nature of the character board, you cannot plot very complicated functions because they would take up more than 128 of the 704 blocks on the screen. The program needs more than 1K, and, if entered after the CHR$ program has been loaded, you can COPY the graph onto the printer.

The QS Character Board has 1K of static RAM on line which can be used for storing data and some machine code programs. The RAM lies between 33792 and 34815. This means that only "relative jumps" can be used in any machine code

that is stored there. There is a 4-way D.I.L. switch on the board which should be off when the ZX81 is in SLOW mode. When the board is being used in FAST mode, or on the ZX80 switches 3 and 4 should be on. All the logic chips and the two 2114s are soldered directly to the PCB which is double-sided.

The board is clearly highly recommended and one of the most useful I have come across. ■

Figure 2. Hi-Res SIN and COS Graphs Using the QS CHR$ Board.

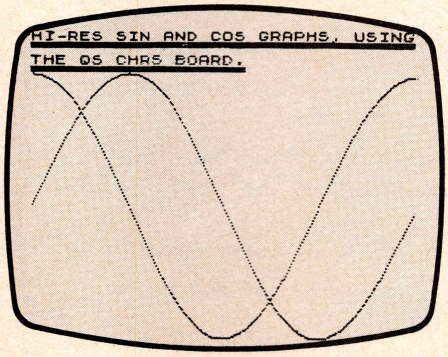


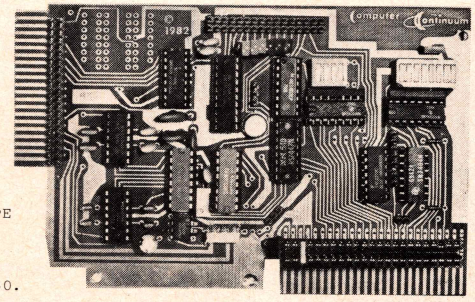
Figure 3. Listing to Generate the Graphs in Figure 2.

```
 20 REM  QS CHRS HI-RES
 21 POKE 32512,58
 22 POKE 32513,12
 23 POKE 32514,127
 24 POKE 32515,95
 25 POKE 32516,58
 26 POKE 32517,13
 27 POKE 32518,127
 28 POKE 32519,179
 29 POKE 32520,6
 30 POKE 32521,0
 31 POKE 32522,79
 32 POKE 32523,201
 40 REM
 50 REM
 60 LET L=USR CLR
 70 FAST
 80 DIM A$(32,176)
 90 DIM B$(32,22)
100 REM  GRAPH EQUATION:
110 FOR X=0 TO 255
120 LET Y=88+86*SIN (X/128*PI)
130 GOSUB 5000
140 LET Y=88+86*COS (X/128*PI)
150 GOSUB 5000
160 NEXT X
170 GOTO 5080
5000 REM  PLOT X, Y INTO BE
5010 IF X<0 OR X>255 OR Y<0 OR Y
>175 THEN RETURN
5020 LET A=INT (X/8)+1
5030 LET B=176-INT Y
5040 POKE 32524,CODE A$(A,B)
5050 POKE 32525,2**(8*A-INT X-1)
5060 LET A$(A,B)=CHR$ USR 32512
5070 RETURN
5080 REM  PRINT AS ON SCREEN
5090 LET C=0
5100 FOR A=1 TO 32
5110 FOR B=1 TO 176 STEP 8
5120 IF A$(A,B)<>" " OR A$(A,B+1
)<>" " OR A$(A,B+2)<>" " OR A$(A
,B+3)<>" " OR A$(A,B+4)<>" " OR
A$(A,B+5)<>" " OR A$(A,B+6)<>" "
 OR A$(A,B+7)<>" " THEN GOSUB 51
60
5130 NEXT B
5140 NEXT A
5150 GOTO 5250
5160 LET C=C+1
5170 IF C>127 THEN GOTO 5250
5180 LET B$(A,1+INT (B/8))=CHR$
(C+64*(C>63))
5190 FOR D=0 TO 7
5200 LET E=CODE A$(A,B+D)
5210 IF C>63 THEN LET E=255-E
5220 POKE 33792+C*8+D,E
5230 NEXT D
5240 RETURN
5250 SLOW
5260 FOR A=1 TO 32
5270 FOR B=1 TO 22
5280 PRINT AT B-1,A-1;B$(A,B)
5290 NEXT B
5300 NEXT A
5310 IF INKEY$="Z" THEN LET L=US
R QCOPY
5320 IF INKEY$="X" THEN GOTO 534
0
5330 GOTO 5310
5340 LET L=USR SINC
```


new **ANALOG** INTERFACE BOARD
8 channels A to D + D to A

fast 2.5 µs A/D CONVERSION TIME. 8 BIT RESOLUTION.

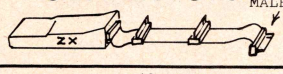
8 CONTINUOUS ANALOG OUTPUTS
0-2.56V (0-5V W/EXT. V_{cc}).
8 ANALOG INPUTS 0-5V.
ADDRESS PICKS CHANNEL.
DIP SWITCHES SELECT MEMORY OR I/O MAPPING AS WELL AS WHICH BLOCK OF ADDRESSES ARE USED.
CAN USE ZX POWER SUPPLY.
UNIQUE DESIGN ALLOWS EASY INTERFACING TO ANY Z80 CPU TYPE MICROCOMPUTER AND OTHERS.
MANY MOUNTING OPTIONS TO ZX81.
FINEST BOARD. NEWEST CHIPS.
KIT $180. ASSEMBLED & TESTED $230.

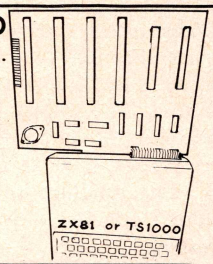


BUFFERED BUS / DEVELOPMENT BOARD
KIT $65. Bare Board $40 W/CONNECTOR & MANUAL.

UHF Modulator RIDS VIDEO INTERFERENCE. REPLACES VHF MODULATOR. **$15**

CONNECTORS FOR 50 WIRE RIBBON. FEMALE TO ZX $7. MALE TO PERIPHERALS $7. GOLD PLATED. ELIMINATES VIBRATION PROBLEMS. USE BOTH CONNECTORS TO AVOID ROW INVERSION PROBLEMS.





TERMS $3 MINIMUM SHIPPING CHARGE. CAL RES ADD 6.5% TAX. PLEASE SEND STAMP FOR MORE INFO. TO ORDER SEND CHECK OR M.O. OR CALL FOR COD. PRICES SUBJECT TO CHANGE.

computer continuum
301 16 th Ave
San Francisco, CA 94118 (415) 752 6294

CYBORGWARS

NOT ANOTHER TOY

BUT A COMPLEX SIMULATION OF FOUR MILITARY-INDUSTRIAL ECONOMIES LOCKED IN A DEADLY STRUGGLE FOR SURVIVAL. ONE TO FOUR PLAYERS COMPETE WITH EACH OTHER AND/OR THE COMPUTER. BALANCE OF POWER DEPENDS UPON SKILL IN DEVELOPING RESOURCES, USE OF ESPIONAGE, EXPLOITATION OF ALLIANCES, AND UTILIZATION OF MILITARY POTENTIAL. REQUIRES ZX81 WITH 8K ROM AND 16K RAM.

ORDER FORM FOR CYBORGWARS

Send $14 (plus $1 for shipping) to: STRATAGEM CYBERNETICS, INC., 286 Corbin Place, 2E, Brooklyn, New York 11235.

NAME _____
ADDRESS _____ CITY _____
STATE _____ ZIP _____

8K ROM
16K RAM

A Keyboard Learning Game

Joseph J. Charles

New users of the Timex/Sinclair computers sometimes spend a long time hunting for a specific key. The keys that are not used frequently remain hard to find. Keygame is intended to help the user become familiar with the keyboard and to have some fun while learning.

Keygame classifies users into five skill levels: 1) beginner, 2) trainee, 3) pro, 4) expert, or 5) master. The character set is subdivided into seven subsets. The beginner is asked to find only the simple keys, i.e., those in the L-cursor mode requiring no shifting. The trainee must cope with the shifted keys. The pro has to find the keyword keys such as PRINT, IF, and SAVE. The function and graphics keys are added for the expert and master, respectively.

As the player's skill level increases, his handicap increases in steps of 10. The beginner has no handicap; a trainee has a 10 point handicap, and so on for each skill level up to a 40 point handicap for the master. Furthermore, less time is allowed to find each key as the skill level increases.

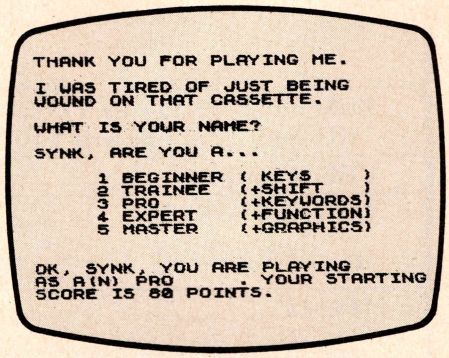
The immediate goal of the game is to score 150 points to win a promotion to the next highest level. The object of the game is to score 150 points at the masters level. Promotions occur automatically when a score of 150 points is attained; demotions occur if one's score falls below one. A player may start at any level desired because the promotion/demotion system is self-correcting. The points gained for each key equal the skill level associated with the key: 1 point for ordinary keys, up to 5 points for the graphics keys. The penalty for a missed key is double the point value of the key.

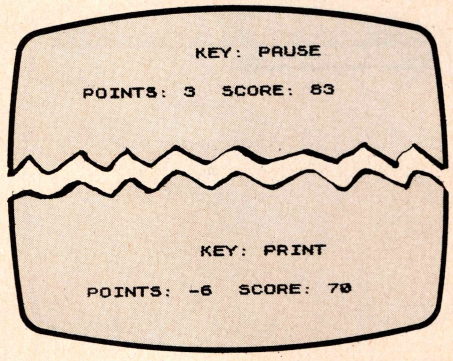
In responding, it is necessary to press the shift key for those keys that normally require it, i.e., shifted keys and graphics keys. It is not necessary to press the shifted 9 first to enter a graphics key response or to press the shifted ENTER key to enter a function key response. The program takes care of that automatically.

One's skill level will increase with playing. If desired, the response time limits can be shortened (or lengthened) by decreasing (or increasing) the value of the first number in the parentheses in line 520.

We hope you enjoy playing Keygame, but, more important, we hope you will be able to master the keyboard in this rather painless way!

Joseph J. Charles, 130 Sherwood Dr., Hilton, NY 14468.





Listing 1. Keyboard Learning Game.

```
  10 REM KEYGAME
  20 REM WRITTEN BY JOSEPH J. CH
ARLES
  30 REM 130 SHERWOOD DR, HILTON
,NY 14468 (716)392-6152
  40 REM 11:45 PM  7/31/82
  50 DIM L$(5,8)
  60 DIM M$(5,9)
  70 SLOW
  80 LET Z$="CPPIJKQWEASDZXRHFGO
LYUN"
  90 LET L$(1)="BEGINNER "
 100 LET L$(2)="TRAINEE "
 110 LET L$(3)="PRO "
 120 LET L$(4)="EXPERT "
 130 LET L$(5)="MASTER "
 140 LET M$(1)=" KEYS"
 150 LET M$(2)="+SHIFT"
 160 LET M$(3)="+KEYWORDS"
 170 LET M$(4)="+FUNCTIONS"
 180 LET M$(5)="+GRAPHICS"
 190 LET W$="1234567890123456789
0"
 200 GOSUB 1030
 210 LET Y$=""
 220 PRINT "THANK YOU FOR PLAYIN
G ME."
 230 PRINT
 240 PRINT "I WAS TIRED OF JUST
BEING"
 250 PRINT "WOUND ON THAT CASSET
TE."
 260 PRINT
 270 PRINT "WHAT IS YOUR NAME? "
 280 INPUT N$
 290 PRINT
 300 PRINT N$;", ARE YOU A..."
 310 PRINT
 320 FOR I=1 TO 5
 330 PRINT TAB (5);I;" ";L$(I);
 340 PRINT TAB (16);"(";M$(I);")
"
 350 NEXT I
 360 PRINT
 370 INPUT L
 380 LET SC=100-10*(L-1)
 390 RAND
 400 PRINT
 410 PRINT "OK, ";N$;", YOU ARE
PLAYING"
 420 PRINT "AS A(N) ";L$(L);". Y
OUR STARTING "
 430 PRINT "SCORE IS ";SC;" POIN
TS."
 440 PAUSE 300
 450 REM
 460 GOSUB 820
 470 CLS
 480 IF S=5 OR S=6 THEN LET L=-2
0
 490 IF S=5 OR S=6 THEN PRINT AT
 1,9;"KEY: ";Y$;" "
 500 IF S<>5 AND S<>6 THEN PRINT
 AT 1,9;"KEY: ";Y$
 510 LET X$=""
 520 FOR J=1 TO (30-2*L)
 530 IF INKEY$<>"" THEN LET X$=I
NKEY$
 540 IF X$<>"" THEN GOTO 560
 550 NEXT J
 560 REM
 570 IF S=3 THEN LET Y$=CHR$ ((C
ODE Y$)-192)
 580 IF Y$>=CHR$ 193 AND Y$<=CHR
$ 218 THEN LET Y$=Z$(CODE Y$-192
)
 590 IF S=5 OR S=6 THEN LET L=5
 600 IF S=5 THEN IF X$<>W$(CODE
Y$) THEN LET P=-2*P
 610 IF S=6 THEN IF X$<>W$(CODE
Y$-118) THEN LET P=-2*P
 620 IF S=5 OR S=6 THEN GOTO 640
 630 IF X$<>Y$ THEN LET P=-2*P
 640 LET SC=SC+P
 650 PRINT
 660 PRINT
 670 PRINT "POINTS: ";P;"  SCORE
 ";SC
 680 IF SC<1 THEN LET L=L-1
 690 IF L=0 THEN LET L=1
 700 IF SC>0 THEN GOTO 730
 710 PRINT N$;" YOU ARE NOW A(N)
 ";L$(L)
 720 GOTO 790
 730 IF SC<150 THEN GOTO 460
 740 IF L=5 THEN PRINT AT 10,0;"
CONGRATULATIONS, ";N$;". YOU AR
E   THE GREATEST."
 750 IF L=5 THEN STOP
 760 LET L=L+1
 770 PRINT "YOU ARE PROMOTED TO
A(N) ";L$(L);"."
 780 PAUSE 150
 790 LET SC=100-10*(L-1)
 800 GOTO 460
 810 STOP
 820 LET S=INT (L*RND+1)
 830 REM SETS:  1:2 7:3:4:5 6:
 840 REM LEVELS:1:  2 :3:4:  5 :
 850 IF L=2 AND S=2 THEN LET S=5
+5*INT (.5+RND)
 860 IF L=5 AND S=5 THEN LET S=5
+INT (.5+RND)
 870 IF S=1 THEN LET Y$=CHR$ INT
 (27+37*RND)
 880 IF CODE Y$=64 THEN GOTO 870
 890 IF S=2 THEN LET Y$=CHR$ INT
 (11+16*RND)
 900 IF CODE Y$=12 THEN GOTO 890
 910 IF S=7 THEN LET Y$=CHR$ INT
 (216+14*RND)
 920 IF S=3 THEN LET Y$=CHR$ INT
 (230+26*RND)
 930 IF S=4 THEN LET Y$=CHR$ INT
 (193+23*RND)
 940 IF CODE Y$=195 THEN GOTO 93
0
 950 IF S=5 THEN LET Y$=CHR$ INT
 (1+10*RND)
 960 IF S=6 THEN LET Y$=CHR$ INT
 (129+10*RND)
 970 LET P=5
 980 IF S=7 THEN LET P=2
 990 IF S=6 THEN LET P=5
1000 RETURN
1010 REM GRAPHICS CODE CONVERSIO
N
1020 REM TYPE SHIFTED KEYWORDS A
S INDICATED BELOW
1030 LET W$(1)=CHR$ 117
1040 LET W$(2)=" AND "
1050 LET W$(3)=CHR$ 112
1060 LET W$(4)=" TO "
1070 LET W$(5)=CHR$ 114
1080 LET W$(6 TO 12)="<> STEP ST
OP SLOW LPRINT "" OR "
1090 LET W$(13)=CHR$ 113
1100 LET W$(14)="<="
1110 LET W$(15)=CHR$ 115
1120 LET W$(16)=">="
1130 LET W$(17 TO 20)=" THEN **
LLIST FAST "
1140 RETURN
1150 REM SYNCSUM=000
```

resources

The "Resources" column lists new products for Sinclair users. Suppliers and users are invited to send brief product descriptions and details for ordering to: Resources, SYNC, 39 E. Hanover Ave., Morris Plains, NJ 07950.

User Groups

Arizona

- New Phoenix ZX80/81 Users Group. Contact:
  Randy Saxton
  4827 N. 63rd Dr.
  Phoenix, AZ 85033
  (602) 846-2882

Connecticut

- The New Haven Sinclair Study Group. Publishes a monthly newsletter for children. $6.00 payable to:
  Chris Baldwin
  Sinclair Study Group
  16 Lewis St.
  New Haven, CT 06513

Illinois

- Chicago/Des Plaines Area Sinclair Users Group (specializing in CIRCLE CHESS). Contact:
  A. F. Stanonis
  PO Box 63
  Des Plaines, IL 60017

Indiana

- Anderson, Indiana, area. Contact:
  Richard K. Berg
  915 Sunset Dr.
  Anderson, IN 46011
  (317) 644-1873 (home)
  (317) 644-8861 (bus.)

Maryland

- Lanham Sinclair Users Group. Publishes *The Computerist,* a newsletter at irregular intervals. Contact the editor:
  Cora C. Dickson
  9528 Elvis Ln.
  Lanham, MD 20706
  (301) 577-6645

Missouri

- Timex/Sinclair Users Group of Kansas City Contact:
  Peter B. Wolcott
  305 West 51st Terr.
  Kansas City, MO 64112
  (816) 753-8546

New York

- Mid-Hudson Users Group. Contact:
  Fr. Bruce O. Bowes
  Church of the Resurrection
  Hopewell Jct., NY 12533
  (914) 226-5727

Pennsylvania

- Central Pennsylvania ZX Users Group.
  Contact:
  Jim Whittaker
  Quarters G, Antrim Dr.
  Mechanicsburg, PA 17055
  (717) 766-8365

- **Turkey**
  Club Mediterranean ZX81
  Mustaffa Sokullu
  Istasyon cad., 43/8
  Goztope, Istanbul
  Turkey

Virginia

- Franklin County area users. Contact:
  Gary Preston
  c/o C. Irvin
  Rte. 1, Box 21
  Glade Hill, VA 24092

Washington, D.C. Area

- Prince George's Sinclair Users Group (PG-ZUG). Contact:
  Jim Wallace
  5442 Tilden Rd.
  Bladensburg, MD 20710
  (301) 699-8712

User Group Forming

- Sinclair users interested in using the ZX81 for stock market technical analysis. Contact:
  Daniel Swenson
  3439 Oakland Ave., S.
  Minneapolis, MN 55407

- Educators and parents interested in applying the Timex/Sinclair to educational settings. Contact:
  M. Mark Wasicsko
  School of Education
  Texas Wesleyan College
  Fort Worth, TX 76105

- World Sinclair users invited to join our sophisticated multi-national club. Send SASE and short computer background.
  The Greater Metropolitan Club of USA
  ZX Users Group of New York
  Box 560 Wall Street
  New York, NY 10005

Indiana/S Illinois/SW Ohio/NW Kentucky Area

- Send long SASE to:
  The FUN-Z
  PO Box 914
  Jasper, IN 47546

Louisiana

- Greater New Orleans Area. Write to:
  E.V. Sandy Blaize
  417 Ridgewood Dr.
  Metairie, LA 70001

New Jersey

- Morris County Area. A ZX80/81 Spectrum Users Group. Contact:
  Larry Spencer
  6 Forest Ct.
  Morris Plains, NJ 07950
  (201) 285-7819 (days) 267-5566 (eves)

RUNNERS!

Road racing program cassettes for TIMEX/SINCLAIR Computers (minimum 2K RAM). $5.95 for sample or send SASE for catalog of programs.

EVANSOFT - Dept. R
1246 Elmwood Avenue
Evanston, IL 60202

1or2K LISTINGS;BERZXORG;
SLOTS;SCREEN STREAKS;3-D
Grapher;Engraver.ALL FOR
$2.00!!Send a SASE & pay-
ment to: M.K.Rossa
1923 Lithia Rd.
VALRICO,FL 33594

ZX TELEPHONE BOOK
• Holds 720 names plus easy ADD/CHANGE/DELETE functions!
• Extensive "learner friendly" documentation even shows you how to add multi-access capabilities!
• Get this high performance 8K/16K listing at BIG SAVINGS:
• Only $4.95 from:
THOMAS B. WOODS
BOX 64
JEFFERSON, N.H. 03583

IMPROVED HEAT SINK for ZX81 & TS1000 eliminates system crashes caused by overheating. $7.95 check/money order or SASE for complete details to:
BASCO, 289 Baxter La, Milford CT 06460

PORT - A - SINC
Port-A-Sinc is a handsome attache style case which includes a spike protected, 8 volt regulated power supply; and a 12 volt, 2.6 AMP-HR, rechargable battery.
Snap your sinclair into port-a-sinc and leave it. You now have a completely portable computer as well as one which is protected against power outages and spikes. For complete details write:
Anderson Engineering
Rt #9, Box 19
Tampa, Fla 33610
Or enclose $140 check or money order for prompt shipment.

IMPORTED GAME CASSETTES
TIMEX + ZX81 16K $14.95 EACH
"10 GREAT GAMES" NEW RELEASE!
JUST IN TIME FOR CHRISTMAS KIDS
"TRADER JACK" FANTASTIC FUN GAME
BUSINESS LOGIC-SOUTH PACIFIC LOCAL
THIS ONE IS FOR DAD AND MOM!
SAVAGE SOFTWARE, PO BOX 441
TITUSVILLE, FL. 32780

ZX81 16K Z80 DISASSEMBLER ON CASSETTE FOR $7.95. PROGRAM IS IN BASIC (5K) SO THAT YOU CAN EASILY MODIFY IT FOR USE WITH THE ZX PRINTER OR YOUR PARTICULAR NEEDS.
ZX81 PROGRAMS
106-B ANTOINETTE CT.
CHARLOTTESVILLE, VA 22903

New York
- Southern Tier Area. Sign-up sheet and information newsletters at:
  Unicorn Electronics, Small Mall
  Harry L. Drive
  Johnson City, NY 13790

Ohio
- Cleveland area. Contact:
  R. F. Sieg
  19502 Thornridge Ave.
  Cleveland, OH 44135

Canada
- Vimont Laval area. Contact:
  Bill Walsh
  125 De Piemont 2
  Vimont Laval H7M 1B7
  Canada

Graphics

- Graphpak: Program using the Sinclair to present statistical information visually and featuring bar graphs, line graphs, pie charts, and area graphs (rectangle divided to show percentage). Program useful for enlivening term papers and proposals, plotting scientific data, assisting in business and family financial planning. Approximately 10K. Regularly $14.95 but $11.95 if ordered before Jan. 31, 1983; s&h included. SASE for details.
  Practical Computer Products
  21111 Strathmoor Ln.
  Huntington Beach, CA 92646

- 4K Graphics ROM for the ZX81. Provides 257 extra characters including lower case letters, graphics for various popular games, and inverses; board can be fitted with up to 4K extra ROM or RAM for machine code, U.D.G.s, etc.; board fits inside the ZX81 case under the keyboard; 3 solder connections. $125.
  Ultimatum
  3470 McKinley Dr.
  Abbotsford, B.C. V2S 6B7
  Canada

- *Magic Graphics.* Draws in 8 directions, lifts and moves the drawing point, redraws the graphic, gives all coordinates of any graphic you create, moves your graphic to new position on the screen. 8K ROM; 16K RAM. $14.95.
  Orbyte Software
  PO Box 948, Dept. SR
  Waterbury, CT 06720
  (203) 753-8308

Power Supplies and Switches

- Power on/off switch for ZX81 or T/S 1000. Greater convenience and eliminates wear and tear on plugs and jacks. 1½ x 1½ x 1 inches; plugs into the computer. $14.95.
  Robert F. Downs
  Lyon Ware
  1520 S. Lyon
  Santa Ana, CA 92705
  (714) 835-9512

- Power supply to meet expansion needs of the T/S 1000, ZX80/81 Well-filtered, 2 amp supply powered by 3 terminal grounded wall transformer; rectifying and filtering elements housed in small black enclosure. Plugs directly into input jack. $19.95 plus $2.50 s&h.
  Hurricane Electronics
  PO Box 87
  Dolton, IL 60419

- ZX81 Power Supply. 2 well-filtered outputs Output 1: 5 volts at 1.5 amps: output 2: screwdriver adjustable from 6.5 to 15 volts at 1.5 amps. Incorporates push button to clear the computer, an LED power-on indicator, and connecting plug and cable; overcomes problem of heat in the original power pack; housed in 5 x 4 x 3 inch aluminum enclosure. $37.50 plus $3.50 s&h. (California residents add 6½ tax.)
  MacSwan-Packaging Co.
  PO Box 4697
  Downey, CA 90241

Educational Programs

- Educational Programs for the ZX81 (16K). Ages in parentheses. French Revisions (14-17); Maths Revisions (14-17); Intermediate Maths 1 & 2 (8-13); Intermediate English 1 & 2 (8-13); Arithmetic for the under 8's; Educational Quiz for all the family. Cassettes, $10 each plus $4 per order shipping and packing.
  Rose Cassettes
  148 Widney Lane
  Solihull
  West Midlands B91 3LH
  U.K.

- *Words.* Exciting fun and education for all ages; six category spelling game; high motivation; positive reinforcement; one or many players. $14.95. *The Quiz.* Math game for grades 1-4; will improve skills at all ages; virtually unlimited problems of addition, subtraction, multiplication with

reinforcement graphics. $12.95.
Orbyte Software
PO Box 948, Dept. SR
Waterbury, CT 06720
(203) 753-8308

- *Lunar Cycle.* Approximation for determining the lunar phase for any day this century; accuracy usually within 1 day; rarely over 3 days. *Permutations and Combinations.* Orders up to 33 items in one group. *Arithmetic and Geometric Progressions.* Computes the value and sum of a specified number of terms with a common difference or ratio, starting with the first user-defined term. 8K ROM; 2K RAM. Listing and directions: $2 for each program.
Stephen Zachev
4859 Elmwood St.
Muskegon, MI 49441

Games

- *Lost in Space.* Moving graphics; flicker-free. Steer ship past meteors and enemy ships; land on fuel ship for bonus; status monitor. 8K ROM; 16K RAM. Cassette and instructions: $11.95 plus $1.50 s&h (New Jersey residents add 5% tax).
M. C. Hoffman Company
PO Box 117
Oakland, NJ 07436

- *Acid Rain. Missile Alert.* Superb graphics. Machine code. 8K ROM; 16K RAM. Both on one cassette: $14.
Chris Taraba
Box 394
Goderich, Ontario
Canada N7A 3Y5

- *Appolo.* Red alert, defend your missile station. $14.95. *Chopper.* Manuever your helicopter through the treacherous cavern, dodge the enemy fire. $19.95. *Mission Escape.* Simulates fight and flight in space; all graphic. $14.95. *Froggy Hop.* Help the frog cross the road to the lake. *Tennis.* Take on the computer. *Gobbling Goblins, Horse Race,* and *High Rollers.* 8K ROM; 16K RAM. Each on cassette: $9.00 except as noted.
Just Games
172 Fifth St.
Stamford, CT 06905.

- *Treasure Seeker.* Graphics fantasy game; search for a treasure through multiroom dungeon while fighting different types of monsters. Three other games included: Skiier, Mars Lander, Crumblin Caverns. 8K ROM; 16K RAM. Cassette: $7.95 plus $1 s&h.
Spartan Software
1403 Gloria Ln.
Boulder City, NV 89005

- *Mars Lander.* Position your cargo ship over your Mars base and land safely. 8K ROM; 16K RAM. For details write:
Mark E Rogers
553 Melrose Dr.
LaPlace, LA 70068

- *Space Adventure.* Choose your speed and direction to navigate through the gravitational fields of four black holes to reach home safely; new configuration of black holes and home planet each run. Cassette and Basic listing: $10.
Aries Associates
511 Mary Ave.
Huntingdon Valley, PA 19006.

- *Demon-Driver.* Car chase with the user vs. the ZX81. Fully machine code. Send international ostal couoon for information sheet. Double-saved cassette, air mail to U.S.: $10; to U.K.: 5.
Mrs. Dan Kurth
Langgasse 51
CH-3292 Busswil
Switzerland

Utility Programs

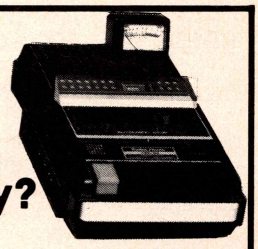
- EX-HEX. Allows user to read, write, and test machine language programs in hexadecimal code; performs from menu: conversions (hex to decimal and decimal to hex), block moves, program insertions and deletions, RAMTOP setting, program saving (including programs stored above RAMTOP). 8K ROM; 16K RAM. Cassette and instructions: $9.95 plus $1 s&h per order.
RCO Technical
PO Box 773
St. Ann, MO 63074

- The Display File Map. $1.00. (Free with order). Further information upon request.
Harthun Engineering and Research
PO Box 111
Albany, KY 42602
(606) 387-8391

- "Teach Your ZX80/81 to Talk." Detailed plans for hardware, parts sources, and software to make your computer produce natural speech; sounds human, not like science fiction robots. 8K ROM. $5.00 pp.
Harthun Engineering and Research
PO Box 111
Albany, KY 42602
(606) 387-8391

- "Adventures in Artificial Intelligence." Life forms created range from simple "reflex" creatures to those capable of "learning" and "killing"; en-

Tape Load Anxiety?



Don't spend a fortune on a disk drive until you try our:

L&G Vu-Load Volume Monitor
- insures program *load* every time
- monitors tape output level
- gives positive *save* indication
- detects blank tape without disconnecting cassette wires
- ready to use—no wiring

Level-Vu Prism
Let's you see recessed tape counter without moving from seat
- attaches easily to recorder body or lid
- fits most recorders including Radio Shack, Vic-20, Atari
- magnifies counter numerals

Vu-Load Monitor $19.95 + 2.50 p & h
Level-Vu Prism $3.95 + 1.00 p & h

L&G Enterprises
P.O. Box 6854
Silver Spring, Md 20906
(301) 774-0126

ARTIFICIAL INTELLIGENCE FOR THE ZX81?
YES!

SYNCZX is an artificial intelligence program with natural language capabilities for the ZX81 with 16K RAM, available from Frog Software.

SYNCZX will talk to you in ENGLISH/NO MENUS. You can use SYNCZX to balance your checkbook or you can reprogram SYNCZX to do anything you would like. However you do not need programming skills to use SYNCZX as is. Even a child can use SYNCZX because it is easy to read and understand, talking to you in simple English. SYNCZX even remembers the people who use it! 16K cassette with manual only $6.95 plus $1.50 postage & handling.

ALSO AVAILABLE
PERSONAL COMPUTING PACKAGE
7 programs. Graphs (1K), Appointment book (16K), Checkbook (16K) and Three Games (1K), etc . . . All 7 for only $1.95 plus .70¢ postage & handling. Send to:

Frog Software
Box 95
Glenmont, New York 12077
(518) 465-6552

EDSON ELECTRONICS OFFERS

Educational programs for grades 1-4 that reinforce what they learn in school. We also offer a digital display load monitor for monitoring data from the cassette to the computer.

Write to
Edson Electronics
P.O. Box 151211
Tampa, Fl. 33684
for free info.

MARKETING SERVICES
For those unfamiliar with techniques in marketing methodology.
Send us your original programs for review.
Send S.A.S.E. for full details, now.
Computer Software Marketing
Box 48595
Chicago, Illinois 60648-0595

IS YOUR FAMILY TIRED OF PLAYING GAMES ON YOUR MICRO?
ARE YOU LOOKING FOR WAYS OF CHALLENGING YOUR INTELLECT?
INTELI-QUIZ IS THE SOLUTION!
Through INTELI-QUIZ you can test your family's or your friends' knowledge on your 16K ZX81.
NOW AVAILABLE
2 Quizzes per cassette
issue 1.1 "General Knowledge" $5.00 each
issue 1.1 "Movie Trivia" $6.00 each
issue 1.1 "Sports Trivia" $6.00 each
Send Check or Money Order to:
S.C.I.
Box 553
Mechanicsville, Virginia 23111
Virginia Residents add 4% sales tax.
Overseas orders add $1.00.

ZX81 VIDEO INVERTER ADDS PROFESSIONAL TOUCH.
NO MORE EYE-STRAIN.
DISPLAY SHARP WHITE CHARACTERS ON SOLID BLACK BACKGROUND TV SCREEN.
A TOGGLE SWITCH LETS YOU CHOOSE BETWEEN NORMAL AND REVERSE.
THE SMALL PRINTED CIRCUIT BOARD FITS INSIDE YOUR ZX81.
ALL FULLY TESTED WITH CONCISE INSTRUCTIONS.
MONEY BACK GUARANTEE.
AVAILABLE AS KIT £5 / $10
READY BUILT £6.50 / $ 13
PRICES INCLUDE AIRMAIL. SEND £ OR $ CHECK.
D. FRITSCH
6 STANTON ROAD
THELWALL
WARRINGTON
CHESHIRE
WA4 2HS
UK

tire "communities" are set up. Machine code for fast action. 8K ROM; 16K RAM. Cassette and manual: $8.95; manual only: $5.00.
Harthun Engineering and Research
PO Box 111
Albany, KY 42602

- *Program "CWSS".* Split screen CW Transceive Program. Received CW is printed on the top 10 lines of the screen; the transmit display, the bottom 10 lines; the two halves scroll independently; will copy CW up to about 40 wpm. Cassette: $10 pp. I/O interface required; 2 board etched circuit board set for the interface: $12 pp.
Cliff Nunnery, NU4V
313 Vaugh St.
Fort Walton Beach, FL 32548

Publications

- *Time/Sinc Directory.* Lists Timex, Sinclair users and user groups in your area. For two issues (early 1983 and mid-1983) send $2.00 and 2 long SASEs to:
Time/Sinc Directory
PO Box 23170
Milwaukee, WI 53223

- *ZX Source List.* An up-to-date listing of over 165 supplies of hardware, software, books, and users groups in the U.S. and Canada. $3.00.
G. E. Topp
PO Box 388
Klamath, CA 95548

- *SYNC-hronizing Education and Games.* Vol. 1, no. 1, now available. Programs include: Shoot the Teacher, Artist 2, Warship, and Attack. Features articles and tips. Yearly subscription (16 programs): U.S., $7.00; Canada, $8.00.
SYNC-hronizing Education and Games
Henry Svec
668 Sherene Terrace
London, Ontario
Canada N6H 3K1

- *QZX.* The journal covering amateur radio and Sinclair computers (ZX80, MicroAce, ZX81, and Timex/Sinclair 1000) is continuing publication with Alex F. Burr, K5XY, as publisher and Ambrose "Bo" Barry, W4GHV/5, as editor. The new address is:
2025 O'Donnell Dr.
Las Cruces, NM 88001

- *The DATAmerica ZX-Index.* A sourcebook of software, hardware, publications, services, and users groups for the ZX80, ZX81, MicroAce, T/S 1000, and Spectrum computers. If you are interested in listing anything, contact:
The DATAmerica Computer Users Group
312 E. 84th St., 1a
New York, NY 10028

- A Directory of software and hardware suppliers being compiled for distribution in the U.S. and West Germany. Suppliers are invited to send information about products and books for inclusion to:
Walter Gampper
Zollamtstrasse 50
675 Kaiserslautern
West Germany

RAM Expansion

- 16K RAM pack for the ZX81. Injection molded plastic case; overcomes wobble and disconnection problems characteristic of other units; optional extra is a keyboard sounder giving audible feedback when a key is pressed. RAM pack: $19.95; RAM pack and sounder: $24.95.
Ground Control
Alfreda Ave.
Hullbridge, Essex SS5 6LT
United Kingdom

- ZX81 2K upgrade. Kit including instructions and IC socket: $14. Send $24 and your ZX81, and have your upgrade done for you.
Micro Basics
5768 Albans Circle
Lithonia, GA 30058

- Expand your ZX81 1K to 16K or 16K to 32K for unde $30. Fits inside yoru ZX81. Plans: $5. SASE for list of peripherals.
T. W. Cook
MACS-24 MCAF
Quantico, VA 22134
(703) 640-3188

- Organic Micro. A collection of modules to expand the ZX81 with the capability of reconfiguration to form an upgraded system in the future. Modules available: Persona—an interface to enable an Organic Micro to Grow on the ZX81 (£24.95); Minimap—a memory mapping device to extend the address space of the ZX81 from 64K to 1M (£29.95); RAM 08— expands RAM from 2K to 8K (£19.95); RAM 16—16K RAM add-on (£21.95); RAM 64—64K RAM add-on (£64.95); Toolkit—a module to take up to 8K of utilities in EPROM/ROM (£17.95); DROM (£32.95); Pericon a (£22.95), b (£27.95), and c (£34.95) —I/O modules; Userfont—user definable characters for RAM 08, DROM, and Toolkit (£6.95).
  BASICare Microsystem Ltd.
  5 Dryden Ct.
  London SE11 4NH
  United Kingdom
  01-735-6408

Joysticks

- Add a joystick to your 8K ROM ZX80. Hooks up in minutes. Plans and parts (does not include Atari type joystick): $6. Specify your machine.
  Ron Howard
  1 Ridgelan, Apt. 5
  Florissant, MO 63031

- Hook up your own Atari joystick to your ZX81. Accessed through basic or machine code; examples given. Complete kit; a little soldering: $39.
  Chris Taraba
  Box 394
  Goderich, Ontario
  Canada N7A 3Y5

EPROM

- I/P Nonvolatile Memory EPROM Programmer. New ZX81 plug on module has 6 I/O prots and 4 sockets for 2K memories; static RAM or 2716 EPROM may be used; save USR program in EPROM for ready access or use static RAMs. Kit: $79; assembled and tested: $99. Low cost EPROM programmer for 2716 EPROM. Interfaces to ZX81 through 3 parallel ports; includes software to program or copy EPROM. Assembled and tested: $79.
  Wisconsin Electronics
  PO Box 332
  Milton, WI 53563

Program Collections

- ZX81 Programs. Tape (3) Business; Tape (5) Quiz; Tape (1) Games; Tape (4) Investment; Tape (6) General; Tape (2) Diet. 8 programs per tape. 8K ROM; 1K RAM. Cassette: $8 each.
  Roman Software
  788 Mercury Circle
  Littleton, CO 80124

- Programs for the ZX81 or T/S 1000. Games, business, household, education, graphics, and other general items. For free catalog send SASE to:
  ZXAD Software Unlimited
  404 Edgewood Dr.
  Exton, PA 19341

Printers & Supplies

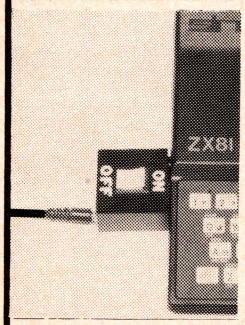
- Paper rolls for the ZX printer now available in the U.S. by mail. Electrosensitive paper with a whiter background for superior contrast and legibility. 3 rolls: $12 postpaid.
  E. Alvarez
  PO Box 1025
  Oviedo, FL 32765

TIMEX and SINCLAIR FORGOT!

Here's

ADD-A-SWITCH

Power switch for Timex 1000 and Sinclair ZX-81



- Installs instantly - no computer modification
- Eliminates plug & jack damage
- Saves hassle - no loose cords in work area
- Protects your computing equipment

Mail to: Lyon Ware, 1520 S. Lyon, Santa Ana, CA 92705

Please send me the ADD-A-SWITCH for $14.95 ea.

☐ Check ☐ Visa ☐ Master Charge

Signature _____

Card No. _____ Exp. _____

Name _____

Street _____

City _____

State _____ Zip _____

Calif. residents add 6% sales tax. Visa, MC add $2 handling.

Lyon Ware is an affiliate of Development Associates

ZX-FORTH

Now you can have the SPEED and POWER of computers costing hundreds or even thousands of dollars more inside your ZX81. FORTH is now available on cassette for the 16K ZX81/TS1000. *EASIER* to learn than BASIC and the most powerful language available for the ZX81 *10 TO 20* times *FASTER* than BASIC and typically uses less than *HALF* the amount of RAM space needed by an average BASIC program. Includes extentions for speedy graphics handling, as well as basic data handling functions. Sample programs written in FORTH included at no extra charge are: Scratchpad, a simple word processor, and Breakforth, an arcade-type game. Also included is a complete bibliography and information about fig-FORTH, the international FORTH users group.

Find out why FORTH is gaining worldwide support as the state of the software art and have fun learning about computers the fast and easy way.

THE FOURTH DIMENSION
1451 N. UNION STREET
MIDDLETOWN, PA 17057

ZX-FORTH™ 16K CASSETTE $34.95
Add $2.00 shipping and handling.
Add $7.00 shipping and handling for foreign orders.

Business/Household Programs

- Z-Wryter Word Processor. Allows user to write, edit, and save text on cassette; edit functions to modifify pages, lines, or individual characters. 8K ROM; 16K RAM. Cassette and instructions: $9.95 plus $1 s&h per order.
  RCO Technical
  PO Box 773
  St. Ann, MO 63074

- Universal Inventory File. Files created by menu and prompts; 2 ways to search; start new files, add, delete, check, and more. 8K ROM; 16K RAM. Cassette & manual, $16.95 postpaid.

- U.S. Savings Bonds. List the series, issue date, serial number, and denomination for 25 bonds; add or delete bonds, make changes, increase or decrease number listed. 8K ROM; 16k RAM. Source list and instructions: $2.50 check or money order.
  John B. Carson, Jr.
  11200 Lockwood Dr., No. 307
  Silver Springs, MD 20901

- *Compu-Stat.* Calculates most descriptive statistics, graphs frequency distribution; menu driven; manual gives step-by-step explanations. Cassette and manual: $9.95.
  Computercraft
  156 Drakes Ln.
  Summertown, TN 38483

- 7 programs for the 1982 tax return. Data is interactively entered, examined, modified; results seen immediately; forms can be printed and/or saved on tape for future use; Form 1040 and Schedules A, B, C, C1/C2, D, and E are featured. Available in January 1983. $14 (cost is deductible).
  KSOFT
  845 Wellner Rd.
  Naperville, IL 60540

- *Universal Inventory File.* $16.95 plus $1.50 s&h. *Universal Mailing List.* $10.95 plus $1.50 s&h. (New Jersey residents add 5% tax.)
  M. C. Hoffman Company
  PO Box 117
  Oakland, NJ 07436

- *ZX Data Finder.* High capacity file manager; versatile catalog/index/reference tool; edit, search, and display routines explained in text; a course on file and data storage techniques. Listing and documentation: $9.95. Data sheets on program capabilities are free.
  Thomas B. Woods
  PO Box 64
  Jefferson, NH 03583

- *The Diggles Kitchen.* A series of cassettes to build up a world wide cookery book using the recipes of John and Angela Diggle. 3 vols. available now: World-wide Cookery, European Cookery, Everyday Family Meals. 2 vols. coming: Chinese and Indian. Prompts the user at each stage. 32K of program; about 28 recipes per tape. $9.99 plus $2 s&h.
  Micro Computer Software
  Unit D6, Pear Industrial Estate
  Stockport Rd., Lower Bredbury
  Stockport SK6 2BP
  United Kingdom
  061-494-2441

Index to Advertisers

Aid Electronics 58
Aadvark Technical 38
Abacus Electronics 86
Abersoft 84
Active Designs 63
Acts Audio 68
Advanced Interface Designs 91
Aerco 6
Apropos Technology 57
Anderson Engineering 116
Aries Association 104
Atto-Soft 110
Audiograph 66
BASCO 116
Basically Software 85
Bob Berch 4, 50
Biocal Software 45
Bi-Pak 72
Bug Byte 11
Byte Back Co. 12
C-20 Magazine 53
C.A.I. Instruments 31
C.E.D. Corp. 47
Cases 86
Circle Chess 58
Cleva Computer Ware 20
Cole Consultants 89
Compu-Tech and Software 40
Computer Continuum 113
Computer Engineering Service 54
Computer Software Marketing 118
Computhink 71
Cook Labs 21
Cosmonics 107
DA Datasystems 85
DK Tronics 7
DSBC 67
Daedalus Software 70
Dallas Development Systems 90
Dancer 58
Data Assette 14,15
Development Association (Lyon Ware) 119
Diggles Kitchen Micro Computer Software 95
Double H 83
Down East Computers 108
Driver Software 43
E-Z Key 13
Edson Electronics 118
Electronic Tech. Today, Inc. 110
Ephemeris V 57
Evansoft 58,116
Expense Cutter 52
Ezra Group II 89
Florida Creations 108
Fourth Dimension, The 119
Fresh Tracks 45
D. Fritsch 118
Frog Software 117
Fuller Micro 24
Peter Furlong Products 4
General Systems Consulting 57
Gibbons, J. P. 91
Gladstone Electronics 60,61
Gotwald 81
Haymarket Software 16, 67
Heath Computer Service 8
Hilderbay Ltd. 81
M.C. Hoffman 58, 68
Hunter 111
Hurricane Electronics 106
Independence Research 104
Infinity Research 78
Intercomputer 84
International Publishing 69
JK Audio 46
JRS Software 28,63
Jenn Products 101
K Soft 70
KML Incorporated 35
Kayde Electronic Systems 23
King Software 58
Kopak Creations Inc. 33
L & G Enterprises 117
Lamo Lem 44
Leading Edge ..... Cover 4
Luxtron Inc. 92
M.C. Associates 56
Maples, William 70
Melbourne House 49
Memory Master 84
Memotech 2
Micro-80 83
Micro Computers Plus 64
Micro Design Concepts 109
Microsync 1
Micro Tech 45
Mikro-Gen 71
Mindware 5
Mohr & Associates 77
Namal Associates 34, 63
Nimrod 45
Nirad 90
Non-Trivial Solutions 10
Nooter Stock Program 101
Omni Technology 94
Orbyte Software ..... Cover 3
Orions's Belt, Enterprises 77
Oxford 99
P & B Software 50
Panda Software 105
Peak 83
Pecos Star Co. 109
Personal Software 24
Photo Lab 58
Powerplay Systems 93
Powertronix 50
Professional Electronics 54
Research Applications Products 57
Robill Products 55, 93
Rom Pac Applications ..... Cover 2
Romark 51
Michael Rossa 116
Run-It Software 47
S.C.I. 118
Santa Fe Industries 45
Savage Software 45, 116
Servitronics 107
Sinclair Place 75
Sinware 42
Siriusware 55
Small Systems Software 93
Smartware 47
Softsync Inc. 18
The Software Farm 94
Southern Computer Systems 37
Space Breaker 54
Strategem Cybernetics 113
Synchronize 17
Syncware 22
Synergistic Design 9
Thurnall 89
Time Data 77
Time Works, Inc. 108
Troiano Software 45
Turner, Elcy and Com 76
Ventamatic Micro-Informatica 84
Upsystems 66
Chris White 35
Woods, Thomas 116
Yagsee 78
York 10 86
Z Ware 92
Zebra X-ray Software 77
Zodex 16
Zopf Industries 50
Zor Khan Industries 51
ZX81 Programs 116
Z X Panding Ltd. 13
Z-West 67

FOR YOUR
TIMEX/SINCLAIR 1000
mega mind
Welcome to the world of Mega Mind.
An intense battle of wit and logic that challenges the human player to dive deep into his powers of concentration.
Compete with the Mega Mind across your mind's universe to break the secret code.
Five levels of play.
(ALSO COMPATIBLE WITH ZX81)
Written in machine code. 16K. $19.95
FREE POSTER WITH ORDER
To place order send $19.95 in check or money order to:
ORBYTE™ SOFTWARE
THE CREATIVE FORCE™
P.O. Box 948, Dept. S, Waterbury, CT 06720
Phone: 203-753-8308
Send for free catalogue for more exciting software.

THE PROWRITER COMETH.

(And It Cometh On Like Gangbusters.)

Evolution.

It's inevitable. An eternal verity.

Just when you think you've got it knocked, and you're resting on your laurels, somebody comes along and makes a dinosaur out of you.

Witness what happened to the Centronics printer when the Epson MX-80 came along in 1981.

And now, witness what's happening to the MX-80 as the ProWriter cometh to be the foremost printer of the decade.

SPEED

MX-80: 80 cps, for 46 full lines per minute throughput.
PROWRITER: 120 cps, for 63 full lines per minute throughput.

GRAPHICS

MX-80: Block graphics standard, fine for things like bar graphs.
PROWRITER: High-resolution graphics features, fine for bar graphs, smooth curves, thin lines, intricate details, etc.

PRINTING

MX-80: Dot matrix business quality.
PROWRITER: Dot matrix correspondence quality, with incremental printing capability standard.

FEED

MX-80: Tractor feed standard; optional friction-feed kit for about $75 extra.
PROWRITER: Both tractor and friction feed standard.

INTERFACE

MX-80: Parallel interface standard; optional serial interface for about $75 extra.
PROWRITER: Available standard—either parallel interface or parallel/serial interface.

WARRANTY

MX-80: 90 days, from Epson.
PROWRITER: One full year, from Leading Edge.

PRICE

Heh, heh.

Marketed Exclusively by Leading Edge Products, Inc., 225 Turnpike Street, Canton, Massachusetts 02021. Call: toll-free 1-800-343-6833; or in Massachusetts call collect (617) 828-8150. Telex 951-624.

LEADING EDGE.™

For a free poster of "Ace" (Prowriter's pilot) doing his thing, please write us.